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EARLY MISSISSIPPIAN BRACHIOPODS FROM THE GLEN PARK FORMATION OF ILLINOIS AND MISSOURI

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ABSTRACT

The Glen Park Formation of east-central Missouri and west-central Illinois contains a diverse brachiopod macrofauna consisting of 45 species assigned to 43 genera. New taxa proposed in this work include the new genera *Ruthiphiala,* type species *Productella sublaevis* Weller, 1914, a chonopectinine; and *Zeugopleura,* type species *Spirifer jeffersonensis* Weller, 1906, a syringothyridiidine. New species are *Rhipidomella rockportensis* n. sp., *Schizophoria hortonensis* n. sp., *Schuchertella hardinensis* n. sp., *Subglobosochonetes jerseyensis* n. sp., *Rugosochonetes pikensis* n. sp., *Orbinaria? brownensis* n. sp., *Nigeroplica? illinoisensis* n. sp., *Argentiproductus auriculatus* n. sp., *Sentosia? ignota* n. sp., *Ovatia nascens* n. sp., *Shumardella fracta* n. sp., *Axiodeaneia glenparkensis* n. sp., *Rhynchopora prisca* n. sp., *Composita matutina* n. sp., *Cardiothyris pristina* n. sp., *Parallelora nupera* n. sp., *Unispirifer senex* n. sp., *Brachythyris hortonensis* n. sp., and *Eomartiniopsis kinderhookensis* n. sp.

The distribution of many short-ranging biostratigraphically useful brachiopod species in the Glen Park Formation and English River Sandstone permits resolution of several correlation problems in the basal Mississippian type sequence. On the basis of its diverse, distinctive brachiopod fauna, the Glen Park Formation is reinterpreted to include similar thin carbonate beds in Illinois which had been variously termed Glen Park, Hamburg oolite or Horton Creek Formation. If the Illinois Hamburg or Horton Creek beds are placed in the basal Carboniferous *Siphonodella sulcata* Zone, as proposed by Sandberg et al. (1972), then the brachiopod fauna of these same beds demonstrates that the type Glen Park of east-central and southeastern Missouri is of the same age. Because of lithologic similarity and for reasons of priority the name Glen Park is retained for these outcrops in both states. Furthermore, the Glen Park Formation, as used here, is correlated with the calcareous English River Sandstone of southeastern Iowa, which is interpreted as a shoreward shallow water shelf facies of the Glen Park. This thin carbonate facies represents the earliest, but very brief, Carboniferous marine transgression into western Illinois, east-central Missouri and southeastern Iowa.

INTRODUCTION

The Glen Park Formation is a thin, in places oolitic, limestone that is discontinuously exposed in and near the bluffs of the Mississippi River in eastern Missouri and west-central Illinois (see Fig. 1). Its subsurface distribution in Illinois is restricted to the west-central portion of the state (Cluff et al., 1981:fig. 42). The subsurface distribution in Missouri has not been published but probably extends beyond the known outcrop limits. The lithology of the Glen Park is highly variable but always includes calcareous components. At various localities it consists of oolitic limestones, limestone conglomerates, biomicrite, silty or sandy limestones or dolomitic limestones, siltstones, shales, or rarely, sandstones. Mehl (1960) and Conkin and Conkin (1973) have also emphasized that it contains poorly sorted rounded quartz sand grains at every outcrop, at least in the basal beds.

Historical Summary of Stratigraphic Terminology

The name Glen Park was first applied to a limestone member of the Sulphur Springs Formation by Ulrich (1904:110) in a published letter to the director of the Missouri Geological Survey. Ulrich distinguished three members in his new Sulphur Springs Formation: an upper sandstone at the top which he named the Bushberg, a middle oolitic limestone called the Glen Park, and a lower shale which he left unnamed.

Ulrich encouraged Prof. Stuart Weller (Weller, 1906:435) of the University of Chicago to investigate the macrofauna of the Glen Park. Weller's description of the stratigraphy and macrofauna provided the first detailed account of the Glen Park Formation. In this paper Weller compared the Glen Park macrofauna to that which he had recovered from an oolite at Hamburg, Calhoun County, Illinois. The latter was the only other known locality in the Mississippi Valley region that contained any significant portion of the Glen Park macrofauna. Weller (1914) later called the beds at Hamburg, Illinois, the Hamburg oolite, being unaware that the name Hamburg had been used twice previously for Cambrian limestones and Tertiary clays. Weller and St. Clair (1928) described additional Glen Park outcrops in Ste. Genevieve County, Missouri, south of the type section.

Moore (1928:138), citing macrofaunal evidence, considered the Hamburg oolite of Calhoun County, Illinois, to be coeval with the Glen Park of Jefferson County, Missouri, and dropped the name Hamburg in Illinois. Branson and Mehl (1933) and Branson (1944) considered the Glen Park to occur as limestone lenses within the Grassy Creek Shale, but this interpretation has not been accepted by others for

both biostratigraphic and lithostratigraphic reasons. Weller and Sutton (1940) and Weller et al. (1948) retained both names, Glen Park and Hamburg and, in the later paper, stated (1948:151) that the Hamburg was best considered a member of the Hannibal Shale. Stainbrook (1950), Rubey (1952), Collinson et al. (1954), Workman and Gillette (1956), and Collinson and Swann (1958), following Moore (1928, 1935), reapplied the name Glen Park to the beds that had been named the Hamburg oolite by Weller (1914) and used by subsequent workers in western Illinois. Rubey (1952) first suggested that the term "formation" was more appropriate for this stratigraphic unit because of its varied lithology, and dropped the appellation "limestone." Mehl (1960) noted that Ulrich (1904) had not designated type sections for his Sulphur Springs Formation and its members and formally designated a type section for the Glen Park Limestone at an old quarry near Glen Park, Jefferson County, Missouri. Collinson (1961) used "Glen Park" in quotes to differentiate it from the type Glen Park which he believed to be substantially older than the Illinois beds because of seeming differences in the conodont faunas. For the next dozen years, Collinson and his colleagues at the Illinois Geological Survey consistently avoided using the name Hamburg because of the above mentioned priority problem and used the term Glen Park within quotes (Collinson et al., 1962; Collinson et al., 1971; Atherton et al., 1975) because of the apparent discrepancy in conodont faunas.

Conkin and Conkin (1973) proposed the name Horton Creek for Collinson's "Glen Park" and for the beds in Illinois referred to by Weller (1914) as the Hamburg oolite. They designated an outcrop on the south bank of Horton Creek, Pike County, Illinois as the type section for their new stratigraphic name, which was proposed as a member of the Hannibal Formation. Cluff et al. (1981) raised Horton Creek to formational rank.

Geographic Distribution and Stratigraphic Relations

As interpreted in this report the Glen Park Formation crops out in Missouri from Ste. Genevieve County in the south to Ralls County in the north with outcrops in most of the intervening counties. Weller and St. Clair (1928) and Moore (1928) reported the occurrence of Glen Park beds in Ste. Genevieve County to the south of the type section. Williams (1943:22; 1957:302) found oolitic "Hamburg" beds near Rensselaer, Ralls County. Mehl (1960) reported outcrops of the Glen Park at a number of localities in Jefferson, Franklin, St. Louis, St. Charles, Warren, and Ste. Genevieve counties. In Pike County, Missouri, Mehl (1960:29) described an outcrop of oolite which he called "Hamburg" because of its occurrence above the Louisiana Limestone and the presumed difference in age from type Glen Park. Martin and Wells (1966:28) also reported fossiliferous Glen Park in St. Charles County.

In Illinois the name Glen Park, as used in this paper and stated above, has been called Hamburg oolite, Glen Park Limestone or Formation, "Glen Park," or Horton Creek Member of the Hannibal or Horton Creek Formation. The Glen Park in Illinois crops out at many places in the bluffs of the Mississippi River in Pike County, more rarely in Calhoun County, and infrequently in Jersey County. Worthen (1870:9–12) first referred to these beds in the vicinity of Hamburg, Calhoun County. Krey (1924:36) described additional exposures in Calhoun and Pike counties. Stainbrook (1950), Rubey (1952), Collinson et al. (1954), Collinson and Swann (1958), Collinson (1961), Collinson et al. (1979) and Collinson et al. (1981) cited numerous Glen Park outcrops in Pike, Calhoun, and Jersey counties.

Subsurface distribution of the Glen Park or associated Kinderhookian sediments in Illinois has been documented by Ball (1952), Workman and Gillette (1956), and Cluff et al. (1981). The latter authors, referring to the Glen Park as the Horton Creek Formation, indicate on their fig. 42 a substantial subsurface distribution of the Glen Park in Illinois with a maximum thickness of about 60 feet in Montgomery and Bond counties, Illinois.

At the type section in Jefferson County, Missouri, the Glen Park is conformable below the Bushberg Sandstone and rests unconformably on the Saverton Shale (called Grassy Creek Shale by Branson and Mehl, 1933). According to Mehl (1960:77), the Glen Park in Missouri unconformably overlies several Ordovician or Devonian formations, including the Kimmswick, Maquoketa, Chattanooga and, possibly, the Plattin. It is usually conformably overlain by either the Bushberg Sandstone or the Hannibal Shale. Mehl (1960:77) indicated that it may be unconformably overlain by the Massie Creek Sandstone in Warren County, Missouri, but the author has recently collected atrypids and stropheodontids in the Massie Creek at its type section, neither of which occur above the Frasnian.

In Illinois, the Glen Park overlies the Louisiana Limestone with a marked erosional unconformity

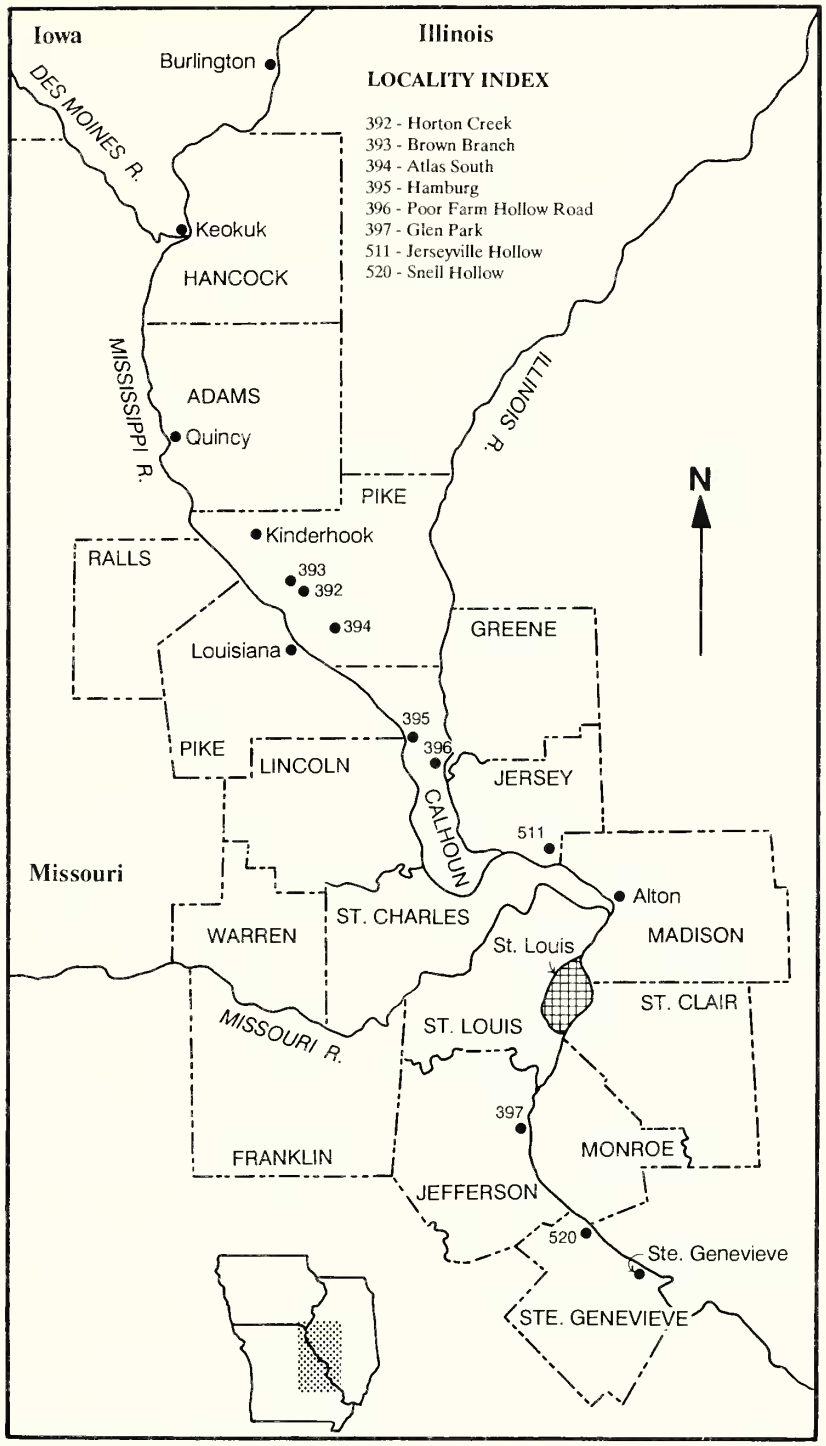


Fig. 1.—Geographic index map showing collecting localities in the Glen Park Formation. The numbers refer to stratigraphic locality collections in The Carnegie Museum of Natural History.

and a basal conglomerate in places, or else with apparent conformity on the Saverton Shale. In the latter cases, Conkin and Conkin (1973) have demonstrated that there is a slight but definite disconformable sedimentary and faunal break at the contact which they have termed a "paracontinuity." In the subsurface, Cluff et al. (1981:47) indicate that the Glen Park may also rest on the Grassy Creek Shale in Madison and St. Clair counties, Illinois.

In western Illinois, the Glen Park is conformably overlain by the Hannibal Shale at all known outcrops. According to Cluff et al. (1981:47), the Glen Park laterally grades into the Hannibal Shale in subsurface eastward but appears to grade laterally into the Louisiana Limestone and Saverton Shale in the subsurface of western Illinois.

AGE AND CORRELATIONS

The precise geologic age of the Glen Park Formation in Missouri has long been in doubt. Although Ulrich (1904) and Weller (1906) suggested that it was probably early Mississippian in age, one must bear in mind that modern notions about the placement of the Devonian-Mississippian boundary differ substantially from those held near the turn of the century.

In recent years, the widespread use of conodont faunal zones, based upon worldwide conodont distributions including those of western Europe, has revolutionized the means for discrimination of this critical boundary. Sandberg et al. (1972) first proposed the modern international conodont zonal scheme for this boundary, defining the latest Devonian as containing the *Siphonodella praesulcata* fauna and the earliest Carboniferous as the base of the *Siphonodella sulcata* Zone. This zonation is now adopted by the IUGS Subcommission on the Devonian-Carboniferous boundary stratotype as the primary means of recognizing the boundary in the northern hemisphere.

In western Illinois, Sandberg et al. (1972:182) noted that Collinson's "Glen Park" and Koenig and Martin's (1961:29, more accurately attributed to M. G. Mehl) "Hamburg oolite" of Pike County, Missouri, in fact contained the *Siphonodella sulcata* Zone fauna and hence were indisputably Carboniferous in age. This conodont zonal scheme used for recognition of the Devonian-Carboniferous boundary is now generally accepted by most biostratigraphers because, at least in the Northern Hemipshere, it is generally consistent and reproducible. In regions where good conodont faunas can be recovered, it provides a biostratigraphic datum from which other faunas and floras that typify this boundary can be correlated.

With this in mind, a brief review of earlier authors' views on the age of the Glen Park, Hamburg, "Glen Park", and Horton Creek is in order. Ulrich (1904), Stuart Weller (1906, 1914), and Moore (1928, 1935), all considered the Glen Park and Hamburg to be early Mississippian in age. Moore (1928, 1935), in fact, dropped the name Hamburg in favor of Glen Park. Weller (1906:466) correlated the Glen Park with the Hamburg of Illinois saying:

> The presence of this fauna at Glen Park and Hamburg may not have been strictly contemporaneous, but its occurrence at the two localities is without doubt associated with the same wave of migration and the fauna at the two localities may be considered to be synchronous within comparatively narrow limits.

Weller and St. Clair (1928:160) reaffirmed this correlation saying:

> In the Hamburg oolite fauna as recorded by Weller, one-half of the species are present also in the Glen Park, and later studies have shown that a still larger portion of the fauna is common to the two formations. The species which do occur in both faunas include two or more peculiar genera which are unknown except in these two faunas. All the evidence at hand points to such a close relationship between the Glen Park and Hamburg faunas that the beds bearing them must be considered as being essentially contemporaneous in origin.

Branson (1938*a*) judged the Glen Park of Missouri to be Devonian in age on the basis of the small macrofauna described by Weller (1906). Later, Branson (1944:174) elaborated saying:

> The Louisiana grades into the Grassy Creek shale in places. Southward the limestone becomes merely lenses in shale. Weller called these lenses the Glen Park and described the fauna as the Glen Park fauna.

In fact, the thicker lenses of Glen Park at its type section often include a basal limestone conglomer-

ate containing large clasts of blue Ordovician Maquoketa Shale, brown micritic Devonian Cedar Valley or equivalent limestone, and greenish gray Saverton Shale of late Famennian age. This obviously indicates a significant erosional unconformity separating the underlying older formations from the sporadically developed limestone lenses of the Glen Park, at least at Glen Park in Jefferson County.

J. M. Weller et al. (1948) correlated the Glen Park of Missouri with the Hamburg beds of Illinois on the basis of faunal similarity and placed them in the Mississippian saying:

> . . . they are clearly part of the Upper Kinderhookian succession, and the Hamburg is best considered a member of the Hannibal.

Note, however, that in this case all of their Lower Kinderhookian is now considered to be of Famennian age.

Mehl (1960:78) found no convincing evidence that confirmed or denied correlation of the type Glen Park with the Hamburg beds of Illinois. Concerning the conodont fauna of the type Glen Park, Mehl said:

> The conodonts that have been found in the Glen Park show trituration.

Most of the triturated conodonts were recognized as Devonian forms and were interpreted as admixtures. He added:

> The best evidence of Devonian age of the Glen Park is that in places it is overlain by the Massie Creek sandstone in which fairly abundant megafauna occurs. This fauna, as indicated elsewhere, argues strongly for the Devonian age of the latter.

Mehl's macrofaunal list for the Massie Creek includes Frasnian, Famennian and Mississippian species of brachiopods. As stated above, the author has recently collected Frasnian or older brachiopods in the type Massie Creek, hence it cannot overlie the Glen Park in normal superposition. In a later paper, Mehl (1961:94) said:

> There is great similarity between the megafossils and the spores found in the Glen Park of east-central Missouri and the Hamburg near its type locality in Illinois. The spores strongly indicate Devonian age of both.

Collinson (1961:102) redefined the Kinderhookian in the type region (Mississippi Valley) to include the base of the "Glen Park" (Hamburg oolite) or Hannibal as the bottom of the series. However, his conodont studies of the type Glen Park (1961:105) suggested to him that the type Glen Park was considerably older than the "Glen Park" beds of Illinois. Collinson et al. (1962) defined a new basal Mississippian conodont assemblage zone, the *Gnathodus* n. sp. B—*G. kockeli* Assemblage Zone, for the "Glen Park" and lowest Hannibal in western Illinois. Collinson et al. (1971) changed the zonal name to the *Protognathodus kuehni—P. kockeli* Zone but retained its meaning and age designation at the base of the Carboniferous. Sandberg et al. (1972: 180, 182) suppressed the latter zonal name in favor of the *Siphonodella sulcata* Zone because of the occurrence of the name giver in the "Glen Park" of Illinois, reaffirming its position at the base of the Carboniferous.

Conkin and Conkin (1973), in assigning a new lithostratigraphic name, the Horton Creek, to the Hamburg oolite of Weller (1914) and the "Glen Park" of Collinson (1961), made no attempt to reconcile their new unit with the type Glen Park of Jefferson County, Missouri. They assigned the entire Horton Creek to the Lower Mississippian (basal Kinderhookian) on the basis of its microfaunas but proposed no formal correlations with other stratigraphic units *per se,* although they did discuss the Devonian-Carboniferous boundary elsewhere in the mid-continent.

Atherton et al. (1975) continued to use "Glen Park" in western Illinois as defined by Collinson (1961), assigning it to the New Albany Group of Devonian and Lower Mississippian age. Cluff et al. (1981:47–50) adopted the term Horton Creek as a formational name. On the basis of physical stratigraphic evidence, they suggested that the Horton Creek might very well be Devonian or straddle the Devonian-Mississippian boundary. Collinson (1985: columns 8 and 9) retained the name Horton Creek for Illinois and placed it at the base of the Mississippian sequence. However, in Missouri, Thompson (1987:column 23) correlated the Glen Park of Perry County, south of St. Louis, with the Conewangoan or late Devonian, although he applied the name Horton Creek of Mississippian age to the *Siphonodella*-bearing outcrops north of St. Louis (1986:17–18).

The previous discussion demonstrates the following: 1) Outcrops of a thin arenaceous carbonate stratigraphic unit, often containing oolitic beds, occur at numerous places on both sides of the Mississippi River, in east-central Missouri and west-central Illinois, in a stratigraphic position just below either the Bushberg Sandstone or Hannibal Shale. The subjacent beds vary from Ordovician to Upper

Devonian units in Missouri but are consistently Saverton Shale or Louisiana Limestone in Illinois outcrops; 2) disconformities or "paracontinuities" commonly occur at the base of this unit on both sides of the river, including the type sections of the Glen Park Limestone, the Hamburg oolite, and the Horton Creek Formation; 3) faunal evidence pointing to a definitive age of these beds for many outcrops, including the type Glen Park, is meager, often based upon negative evidence, triturated conodont specimens, or sparse poorly studied macrofaunas; 4) this stratigraphic unit in Illinois and Pike County, Missouri, has been convincingly dated as basal Carboniferous by Collinson (1961) and Sandberg et al. (1972).

Present Study

The distinctive brachiopod fauna described below is based upon faunally diverse collections from the type sections of the Glen Park, Hamburg oolite, and Horton Creek, as well as other fossiliferous outcrops. Table 1 shows the distribution of the entire brachiopod fauna of the Glen Park Formation at each important collecting locality and includes the comparable English River Sandstone fauna in the right hand column. With the exception of the rare punctate orthid referred to here as *Aulacella* n. sp. and the single productid specimen described here as *Quadratia?* sp., every species found in the type Glen Park of Missouri also occurs in the Illinois beds. The most common species at Glen Park, Missouri, are *Schuchertella hardinensis* n. sp., *Subglobosochonetes jerseyensis* n. sp., *Sedenticellula hamburgensis* (Weller), *Rhynchopora hamburgensis* Weller, *Cardiothyris pristina* n. sp., *Tylothyris missouriensis* (Weller), *Zeugopleura jeffersonensis* (Weller), and *Dielasmella compressa* (Weller). In addition, *Plicochonetes? glenparkensis* (Weller), *Axiodeaneia glenparkensis* n. sp., and *Syringothyris extenuata* (Hall) are diagnostic elements of this fauna. Weller (1906) did not report *Sedenticellula hamburgensis* (Weller), *Rhynchopora hamburgensis* Weller, or *Cardiothyris pristina* n. sp. at Glen Park. However, one may speculate that his *Camarotoechia* sp. undet., and his *Seminula* sp. undet. refer to the latter two taxa.

Weller found a single specimen of a true atrypid at Glen Park, which he named *Atrypa infrequens* in 1914. This specimen has a broken lateral extremity that displays a brown sandy micritic limestone internal matrix and surely came from one of the common Middle Devonian limestone clasts that occur in the Glen Park conglomerate lenses at Glen Park, Missouri.

The key exposure for correlation of the Glen Park Limestone is at Brown Branch, Pike County, Illinois (SL 393). The faunas, both macrofauna and microfauna, were discovered by Charles Collinson of the Illinois Geological Survey. The micritic limestones at this locality are richly fossiliferous (Collinson et al., 1979:34, 35) and the brachiopod fauna is the most diverse of the entire Glen Park or, in fact, for this stratigraphic interval in North America. This remarkable fauna contains 34 species of brachiopods in 32 genera. As can be seen in Table 1, nine of 14 species from the type Glen Park occur here. Eight of nine type Hamburg species and 11 of 15 type Horton Creek species are found at Brown Branch. Most intriguingly, 11 English River Sandstone species occur here, including many of the distinctive species that do not range above the English River, such as *Schizophoria hortonensis* n. sp., *Schuchertella hardinensis* n. sp., *Whidbornella curtirostris* (Winchell), *Mesoplica? mesicostalis* (Weller), *Ovatia nascens* n. sp., *Eudoxina subrotunda* (Weller), and *Syringothyris extenuata* (Hall). In addition, Weller (1914), Moore (1928), and Collinson (1961) list several other species from the basal Hannibal near Kinderhook, Illinois (called English River Sandstone by Moore) that also occur at Brown Branch.

To summarize, the brachiopod faunas of every macrofossiliferous locality in the Glen Park of Missouri and the Hamburg or Horton Creek of Illinois seen by this writer are readily correlated with the diverse fauna at Brown Branch, and the latter is clearly correlated with the English River Sandstone of southeastern Iowa and west-central Illinois. The lack of a *Siphonodella sulcata* conodont fauna at the type Glen Park or other Glen Park localities in Missouri is anomalous. However, well preserved indigenous conodonts are known to be rare in oolitic limestones. The type English River Sandstone in southeastern Iowa also bears this early Mississippian *Siphonodella sulcata* conodont fauna (Collinson, 1961:106). But another anomaly in conodont distribution occurs at Burlington, Iowa, where the same English River Sandstone has not produced Mississippian conodonts (Collinson, 1961:106). The lack of early Mississippian *Siphonodella* faunas at some localities is unfortunate, but the implications of the brachiopod distributions are plain: all macrofossiliferous localities in the Glen Park of Missouri, the Hamburg and Horton Creek of Illinois, the lower Hannibal near Kinderhook, Illinois, and

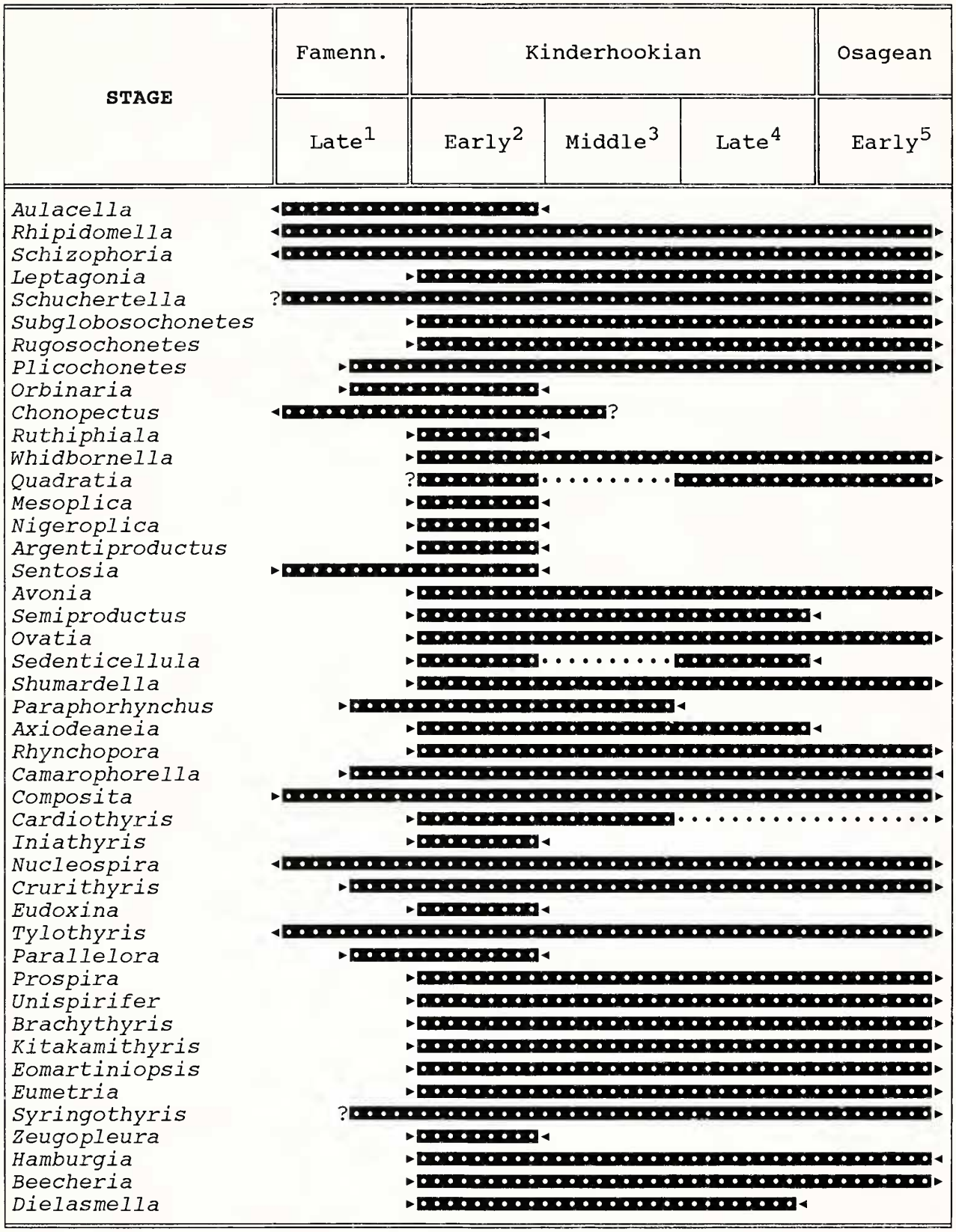
Table 1.—*Distribution of brachiopod species within the Glen Park Formation. Data for the right hand column is for Glen Park species that also occur in the English River Sandstone of southeastern Iowa and west central Illinois.*

Brachiopod species	Stratigraphic localities (SL)								
	392	393	394	395	396	397	511	520	ERS
Lingula sp.			X						X
Orbiculoidea sp.		X							X
Aulacella n. sp.								X	
Rhipidomella rockportensis	X	X	X				X		
Schizophoria hortonensis	X		X						X
Leptagonia cf. *missouriensis*		X							
Schuchertella hardinensis		X		X	X	X	X	X	X
Subglobosochonetes jerseyensis						X	X		
Rugosochonetes pikensis		X							
Rugosochonetes cf. *gregarius*	X	X	X						X
Plicochonetes? glenparkensis	X	X	X	X		X		X	
Orbinaria? brownensis		X							
Ruthiphiala sublaevis		X							X
Whidbornella curtirostris		X							X
Quadratia? sp.						X			
Mesoplica? mesicostalis		X							X
Nigeroplica? illinoisensis	X								
Argentiproductus auriculatus		X							
Sentosia? ignota		X							
Avonia sp.		X							
Semiproductus sp.		X							
Ovatia nascens	X	X							X
Sedenticellula hamburgensis		X		X	X	X		X	
Shumardella fracta	X		X						
Paraphorhynchus sp.		X							X
Axiodeaneia glenparkensis					X	X		X	
Rhynchopora hamburgensis	X	X		X	X	X	X		
Rhynchopora prisca		X							
Camarophorella cf. *buckleyi*		X							
Composita matutina	X	X							
Cardiothryis pristina					X	X			
Nucleospira minima				X	X	X			
Crurithyris cf. *levicula*	X		X						
Tylothyris missouriensis		X	X	X	X	X		X	
Parallelora nupera	X	X	X						
Unispirifer senex		X							
Brachythyris hortonensis	X	X							
Eudoxina subrotunda		X							X
Kitakamithyris cooperensis	X	X	X						X
Eomartiniopsis kinderhookensis	X	X	X						
Syringothyris extenuata	X	X			X	X	X	X	X
Zeugopleura jeffersonensis		X		X	X	X	X	X	
Hamburgia typa		X		X	X			X	
Beecheria paraplicata		X		?	X	X			
Dielasmella compressa		X		X	X	X		X	

the English River Sandstone of southeastern Iowa are the same age and can be confidently correlated. Differences in age due to the rate of transgression from south to north cannot be detected. It is safe to conclude that if this carbonate unit contains the *Siphonodella sulcata* Zone fauna at several outcrops in west-central Illinois and Pike County, Missouri, the entire unit can be considered to be of early Kinderhookian age, including the calcareous English River Sandstone of southeastern Iowa.

Correlations Outside the Mississippi Valley Region

Forty-one genera of articulate brachiopods occur in the Glen Park Formation. Figure 2 shows the stratigraphic distribution of articulate brachiopod


STAGE
Famenn.
Kinderhookian
Osagean
Late[1]
Early[2]
Middle[3]
Late[4]
Early[5]
Aulacella
Rhipidomella
Schizophoria
Leptagonia
Schuchertella
Subglobosochonetes
Rugosochonetes
Plicochonetes
Orbinaria
Chonopectus
Ruthiphiala
Whidbornella
Quadratia
Mesoplica
Nigeroplica
Argentiproductus
Sentosia
Avonia
Semiproductus
Ovatia
Sedenticellula
Shumardella
Paraphorhynchus
Axiodeaneia
Rhynchopora
Camarophorella
Composita
Cardiothyris
Iniathyris
Nucleospira
Crurithyris
Eudoxina
Tylothyris
Parallelora
Prospira
Unispirifer
Brachythyris
Kitakamithyris
Eomartiniopsis
Eumetria
Syringothyris
Zeugopleura
Hamburgia
Beecheria
Dielasmella

genera in the latest Devonian and early Mississippian of North America. This figure is based upon data from the writer's field collections, museum collections, and all relevant published data that permit confident modern generic assignments. No fewer than 25 genera of articulate brachiopods occur first in the Glen Park Formation. Three other genera occur first in the English River Sandstone, which is considered here to be a near-shore correlative facies of the Glen Park. In addition, 11 genera last occur in the Glen Park and seven are restricted to this interval. The sudden appearance of 28 articulate brachiopod genera at the base of the Kinderhookian, and at or very near the base of the *Siphonodella sulcata* Zone, should facilitate recognition of this important boundary elsewhere.

Although 15 Famennian genera carry over into the Glen Park-English River fauna the appearance of 28 new genera gives the early Kinderhookian faunas a radically different aspect. Several late Famennian brachiopod faunas in North America have been thoroughly described or redescribed by Williams (1943), Cooper and Dutro (1982), and Rodriguez and Gutschick (1967).

The early late Famennian Percha fauna of New Mexico (Cooper and Dutro, 1982:24) contains only four articulate genera that range upward into the Glen Park. Of these four, the genera *Sentosia, Composita,* and possibly *Schuchertella* first appear in the Percha, the punctate orthid genus, *Schizophoria* is long ranging and of less biostratigraphic value. The first occurrence of *Schuchertella* is difficult to ascertain. Cooper and Dutro (1982:54) discuss the problem of distinguishing pseudopunctate and impunctate taxa.

The diverse excellently preserved brachiopod fauna of the very late Famennian Louisiana Limestone bears the late Devonian fauna most similar to that of the Glen Park. Because of its latest Famennian age, as confirmed by the presence of the *Siphonodella praesulcata* conodont fauna, geographic occurrence in the type region of the Mississippian System, and diverse well documented brachiopod fauna, it provides an acceptable datum for discrimination of this horizon for both micro- and macrofaunas.

The brachiopod fauna of the Louisiana Limestone and upper Saverton Shale is well known through the monographic descriptions of Rowley (1908), Weller (1914), and Williams (1943). Large excellent collections are available for study at many institutions as well. Remarkably few Louisiana species appear to carry over into the Glen Park. Only the *Rhipidomella "missouriensis"* and *Camarophorella buckleyi* (Rowley) could be close to or identical with Glen Park species. Comparison at the genus level may be more appropriate. Twelve genera from the Louisiana, mostly long ranging forms, occur in the Glen Park. In North America, six of these first occur in the Louisiana, namely *Plicochonetes, Orbinaria, Paraphorhynchus, Camarophorella, Crurithyris,* and *Parallelora.* Another, *Syringothyris* possibly first occurs here as well. This latter genus is very common in the late Famennian of the eastern United States in beds that cannot be dated by means of conodonts. Until more precise correlations are achieved the range of *Syringothyris* cannot be determined. Two genera, *Orbinaria* and *Parallelora,* occur only in the Louisiana and Glen Park. In general faunal aspect, the Louisiana differs greatly from the Glen Park.

Rodriguez and Gutschick (1967) described several brachiopod faunules from the Sappington Formation of Montana. The faunule from their Unit E was correlated with the Louisiana Limestone. Units F–H appear to be early Kinderhookian (Sando et al. 1969:E9). Some of the brachiopod species described by Rodriguez and Gutschick from their Unit E are closely similar to species in the Glen Park Formation. Their *Schuchertella lens* (White) is more similar to *Schuchertella hardinensis* n. sp. than to the Louisiana Limestone species. Also their *Rhytiophora? arcuatus* (Hall) from Unit E, not Unit F, is comparable to *Nigeroplica? illinoisensis* n. sp. *Beecheria paraplicata* Rodriguez and Gutschick was described from both Units E and F. In the Missis-

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Fig. 2.—North American stratigraphic ranges for articulate brachiopod genera that occur in the Glen Park Formation and the English River Sandstone. [1] Based on occurrences in the Louisiana Limestone and upper Saverton Shale, Percha Shale and Sappington Formation. [2] Based on occurrences in the Glen Park Limestone, English River Sandstone, basal Hannibal Shale of western Illinois and Sappington Formation. [3] Based on occurrences in the Chouteau Limestone and Sedalia Dolomite, upper Hannibal Shale and McCraney through Wassonville sequence. [4] Based on occurrences in the Gilmore City-Eagle City-Maynes Creek facies, Chappel Limestone, upper Northview Shale and "middle" Banff. [5] Based on occurrences in the Meppen, Fern Glen, lower Burlington Limestone, Baird Mountain Member of the St. Joe and "upper" Banff Formation.

sippi Valley it occurs only in the Glen Park Formation. However, some of their speeies from Unit E, such as *Tylothyris clarksvillensis* (Winchell), do point to a Louisiana Limestone or late Famennian correlation. On the whole, the Unit E faunule appears to be more similar to that of the Glen Park than to that of the Louisiana Limestone.

The small Famennian fauna described from the Pilot Shale of Nevada by Johnson and Reso (1966), and tentatively correlated with the Louisiana Limestone, contains no definitive Glen Park elements. Rodriguez and Gutschick (1967:368) equated their Unit E fauna with that of the Johnson and Reso fauna from the Pilot Shale.

Sando et al. (1969:E9, fig. 4) included a pre-A Zone in their megafaunal zonation scheme for the Carboniferous of the northern Cordillera. Their list of unillustrated taxa from this zone is not incompatible with the Glen Park fauna described below but a direct correlation is not possible under the circumstances.

Thus, the latest Devonian Louisiana Limestone–upper Saverton fauna of the Mississippi Valley is well known, as are some of the late Devonian Cordilleran faunas. The age and correlations of many of these units are well supported by conodont studies. Other smaller Cordilleran brachiopod faunas of probable late Famennian age have been reported by Johnson and Reso (1966) from the Pilot Shale of Nevada, and Rodriguez and Gutschick (1978) from the Leatham Formation of Utah.

Terrigenous clastie beds that span the Devonian-Mississippian boundary occur at many places in the east-central United States. Conodont faunas are generally lacking and placement of the boundary is highly problematical. Few brachiopod faunas have been described. Two such faunas are possibly of basal Mississippian age. Girty (1928) described a small brachiopod fauna from the Riddlesburg Shale Member of the Rockwell Formation in south-central Pennsylvania. One species of this small fauna suggests correlation with the Glen Park Formation. This is *Spirifer compositus* Girty, 1928, which should be referred to the new genus described here as *Zeugopleura*. It appears to be very closely related to *Zeugopleura jeffersonensis* (Weller).

A more diverse fauna has been listed from the Corry Sandstone of northwestern Pennsylvania by Caster (1934) and Sass (1960). Undescribed species in part of the Sass Collection, now deposited at The Carnegie Museum of Natural History, include coarsely denticulate spiriferids of the *Prospira* type and a species of *Ovatia*. These faunal elements may indicate an early, possibly basal, Mississippian age for the Corry, and possible correlation with the Glen Park Limestone. The several species of *Paraphorhynchus* described by Sass (1960) also suggest a Mississippian age, although Williams (1943:83) found a single specimen probably assignable to this genus at the base of the Louisiana Limestone.

Correlations outside North America

Intercontinental correlations for the Carboniferous by means of brachiopods are not common. Most of this reluctance to use brachiopods is due to different interpretations of brachiopod genera and a lack of integrated faunal studies (Brunton, 1984*a*, 1985). Although it is undeniable that some brachiopod faunas are unusually endemic and of limited geographic distribution, in general, the use of brachiopod assemblages shows promise for intercontinental correlation (Brunton, 1984*a*, 1985). In the case at hand, intercontinental correlations made by means of brachiopods are hampered by the lack of information concerning the exact position of the base of the *Siphonodella sulcata* Zone in documented brachiopod bearing beds of Eurasia.

Dehée's (1929) monograph on the fauna of the Etroeungt beds of western Europe provides an invaluable basis for comparisons between North American and western European latest Famennian brachiopod faunas. Unfortunately, no modern work dealing with the early Tournaisian brachiopods of Belgium is available for comparison with North American faunas. Comparison with Devonian-Carboniferous boundary faunas in the Soviet Union is hampered by interpretation of the position of the boundary and the paucity of published conodont occurrences. In a recent paper Fotieva (1985) describes and illustrates many genera of brachiopods from the Famennian-Tournaisian boundary beds of the Timan-Pechora province and the western slope of the Urals. Along with many common Devonian genera she reports the following genera from the Lytvinskiy horizon: *Leptagonia, Spinocarinfera, Nigeroplica, Productina, Ovatia, Unispirifer, Punctospirifer,* and *Dielasma*. Although this horizon is attributed to the early Carboniferous by Fotieva, the more complete faunas listed for the Lytvinskiy horizon by Sultanaev (1975:5–9) include Devonian conodonts, clymenid ammonoids, and numerous Etroeungt-type brachiopods. These faunal elements are interpreted here to indicate a late Famennian age for the Lytvinskiy. None of the genera listed

above has been reported in the Famennian of North America. In the superjacent (early Carboniferous) horizon Fotieva reports the presence of *Eomartiniopsis, Eudoxina, Cleiothyridina,* and *Cardiothyris* which also occur first in the Glen Park Formation in North America. Thus, it appears that many brachiopod genera that first occur in the Glen Park in North America first occur in Famennian age rocks in the Soviet Union, as interpreted by this writer.

FOSSILIFEROUS SEDIMENTARY FACIES

In general, the Glen Park Formation is sparsely fossiliferous and most Glen Park outerops lack macrofossils. Brachiopods are the most common macrofossils but molluscs are abundant at the type section of the formation. Other macro-invertebrates are very rare. The brachiopods occur in only several of the many Glen Park lithologies, namely, biomicrite, oosparite, silty dolomite or dolomitic limestone, and calcareous sandstone or arenaceous limestone. Invariably, they are found in only one lithology at each collecting locality, often only in one bed.

Many benthonic marine invertebrates are often referred to as "facies fossils" and are presumed to have very limited distribution in various sedimentary environments. In fact, as pointed out by Brunton (1984*a*:38), fossil articulate brachiopods are found in most normal marine sedimentary rock types except those that indieate extremely rapid sedimentation or contain excessive amounts of clay-sized particulates held in suspension. Table 2 shows the occurrences of Glen Park brachiopods in the four fossiliferous types of carbonate or carbonate cemented sediments of the Glen Park. By far the most diverse fauna occurs in the thin biomicrite at Brown Branch (SL393). Of the 34 species that occur here, ten are known only from this facies. Another 11 species also occur in two or three other facies, indicating probable eurytopic adaptation to bottom conditions for these species, assuming these species were indigenous to their collecting localities. The other 16 species occur in two of the fossiliferous facies. The distribution of species in the other remaining three facies is even more dispersed. All ten species from the spar-cemented oolite at Hamburg (SL395) occur in one or more other facies, and this entire faunule may be allochthonous. Only three of 17 species from the silty dolomitic facies (SL392 and SL394) are unique to this lithology and only four of 26 speeies that oceur in calcareous sandstone or arenaceous limestones are limited to that depositional environment.

Twenty-seven of the 45 species described in this report occur in more than one sedimentary facies and several of the 17 restricted species are so rare as to be represented by only a few individuals or even a single specimen. Very similar younger articulate brachiopod faunal distributions occur in the Prospect Hill Sandstone, Starr's Cave Oolite and Wassonville Dolomite of southeastern Iowa and micritic Chouteau Limestone and Sedalia Dolomite of Missouri. It may be concluded that, at least in Lower Mississippian normal marine shelf sediments, many articulate brachiopod species could tolerate a variety of substrates and sediments.

Williams (1957) interpreted the oolitic beds of the Glen Park to represent deposition in very shallow water which may have been withdrawn from time to time. This was suggested by cross-bedding, ripple marks, and the lenticular nature of the oolitic beds. Distribution of the "Horton Creek" facies which includes these oolites in Illinois is well shown by Cluff et al. (1981:fig. 42) but, unfortunately, they were not able to differentiate and map its temporal equivalents, the English River Sandstone (or lower Hannibal Shale) from other New Albany Group sediments. Their interpretation of the distribution of the basin and shelf facies and general paleogeography for the entire New Albany Group (Cluff et al. 1981:59, 60, fig. 48) probably applies equally well to the restricted early Kinderhookian interval of the Glen Park and English River or lower Hannibal.

The erosional surfaces sometimes recorded at places in the basal beds of the Glen Park, occasional conglomerate beds, and thin basal quartz sandstones or thin layers of rounded sand grains at the base of the Glen Park, suggest a short but definite erosional hiatus at the end of the Devonian, reflecting a brief withdrawal or shallowing in at least part of the northern or Mississippi Valley marine lobe of the late Devonian mid-continental seaway. The oosparites, biomicrites, silty dolomites and arenaceous limestones or calcareous sandstones of the Glen Park are facies that record a brief, rapid, very shallow marine transgression that extended northward from

Table 2.—*Occurrences of brachiopods according to sedimentary facies. The right hand column includes Glen Park species that also occur in the calcareous sandstone of the English River Formation at Kinderhook, Illinois, and near Burlington, Iowa.*

Brachiopod species	Sedimentary facies			
	Bio-micrite	Oo-sparite	Silty Dol.	Aren. Ls. or Calc. Ss.
Lingula sp.			X	X
Orbiculoidea sp.	X			X
Aulacella n. sp.				X
Rhipidomella rockportensis	X		X	X
Schizophoria hortonensis			X	X
Leptagonia cf. *missouriensis*	X			
Schuchertella hardinensis	X	X		X
Subglobosochonetes jerseyensis				X
Rugosochonetes pikensis	X			
Rugosochonetes cf. *gregarius*	X		X	X
Plicochonetes? glenparkensis	X	X	X	X
Orbinaria? brownensis	X			
Ruthiphiala sublaevis	X			X
Whidbornella curtirostris	X			X
Quadratia? sp.				X
Mesoplica? mesicostalis	X			X
Nigeroplica? illinoisensis			X	
Argentiproductus auriculatus	X			
Sentosia? ignota	X			
Avonia sp.	X			
Semiproductus sp.	X			
Ovatia nascens	X		X	X
Sedenticellula hamburgensis	X	X		X
Shumardella fracta			X	
Paraphorhynchus sp.	X			X
Axiodeaneia glenparkensis				X
Rhynchopora hamburgensis	X	X	X	X
Rhynchopore prisca	X			
Camarophorella cf. *buckleyi*	X			
Composita matutina	X		X	
Cardiothyris pristina				X
Nucleospira minima		X		X
Crurithyris cf. *levicula*			X	
Tylothyris missouriensis	X	X	X	X
Parallelora nupera	X		X	
Unispirifer senex	X			
Brachythyris hortonensis	X		X	
Eudoxina subrotunda	X			X
Kitakamithyris cooperensis	X		X	X
Eomartiniopsis kinderhookensis	X		X	
Syringothyris extenuata	X		X	X
Zeugopleura jeffersonensis	X	X		X
Hamburgia typa	X	X		X
Beecheria paraplicata	X	?		X
Dielasmella compressa	X	X		X

southern Missouri and Illinois into central Iowa, approaching the Transcontinental Arch, at the beginning of the Carboniferous, rapidly reoccupying much of the same region in which the Saverton-Louisiana-Maple Mill had been deposited in the very late Famennian.

Preservation

Preservation of adult shells is the norm at most collecting localities, but the high-energy sedimentary environments indicated by the varied Glen Park lithofacies precluded the retention of much micro-ornament. Most shells show some evidence of abrasion. Except for the *Rhipidomella rockportensis* n. sp., *Schizophoria hortonensis* n. sp., *Parallelora nupera* n. sp., *Eomartiniopsis kinderhookensis* n. sp., and *Kitakamithyris cooperensis* (Swallow) from locality SL392, complete specimens of strophic species could not be found at other localities, including the very diverse fauna from the biomicrite at locality SL393. Complete specimens of rostrate species, however, are common for the following species: *Sedenticellula hamburgensis* (Weller), *Rhynchopora hamburgensis* Weller, *Dielasmella compressa* (Weller), and *Shumardella fracta* n. sp. Several rare complete shells of *Hamburgia typa* Weller, *Crurithyris* cf. *levicula* (Rowley) and *Nucleospira minima* Weller were also found.

Cloud (1948) commented on the small size of the brachiopods found in the "Hamburg oolite" in his discussion of assemblages of diminutive brachiopods. He concluded that the concentration of small specimens in his Glen Park collections were the result of current action. His prediction that larger adult stages of the tiny Hamburg juveniles would be found in laterally equivalent rocks is only partially borne out by this study. The most common species recovered by this writer from the oosparite at Hamburg, Illinois, include small *Schuchertella hardinensis* n. sp., small *Sedenticellula hamburgensis* (Weller), normal adult-sized *Rhynchopora hamburgensis* Weller, medium to large *Tylothyris missouriensis* (Weller), large *Dielasmella compressa* (Weller), large *Nucleospira minima* Weller, and medium to large *Hamburgia typa* Weller. The *Schuchertella hardinensis* n. sp. and *Sedenticellula hamburgensis* (Weller) do reach their largest adult size elsewhere, the former in the arenaceous limestone at locality SL396, and the latter at localities SL393 and SL397 (type Glen Park).

Punctation in *Rhynchopora hamburgensis* Weller and *Zeugopleura jeffersonensis* (Weller) is ordinarily difficult to detect at most collecting localities. Also, the characteristic syringothyridid micro-ornament of the latter species was preserved in only a few of the hundreds of specimens used in this study.

FAUNAL COMPOSITION

The fauna described below contains representatives of almost every major brachiopod group that is normally found in Kinderhookian strata of North America. Figure 2 and Tables 1 and 2 give the generic composition of the fauna and species distribution. There are two inarticulates, three punctate orthids, two strophomenids, four chonetids, eleven productids, one pentamerid (stenoscismatacean), three impunctate rhynchonellids, two punctate rhynchonellids, four athyridids, eight impunctate spiriferids, two punctate spiriferids (syringothyridids), and three terebratulids. No major brachiopod group found in younger Kinderhookian beds is missing although some groups are poorly represented when compared with their abundance in late Famennian strata.

Inarticulates.—Only two genera are represented here and specimens are very rare. The long-ranging genera *Lingula* and *Orbiculoidea* are of little biostratigraphic value.

Punctate orthids.—The genera *Aulacella, Rhipidomella* and *Schizophoria* are all long ranging. The specimens identified here as *Aulacella* n. sp. represent the first report of this genus in well-dated Mississippian rocks in North America. *Rhipidomella rockportensis* n. sp. is similar to the Chouteau species widely identified as *Rhipidomella missouriensis* (Swallow), an invalid name, and may have an extensive stratigraphic range. *Schizophoria hortonensis* n. sp. appears to be a distinctive short-ranging species.

Strophomenids.—*Leptagonia,* not present in the late Famennian, first appears at a single locality in the Glen Park Formation. The species identified here as *Leptagonia* cf. *L. missouriensis* Carter may range throughout the Kinderhookian into the early Osagean. The only Glen Park orthotedid, *Schuchertella hardinensis* n. sp., seems to be restricted to this horizon.

Chonetids.—*Plicochonetes? glenparkensis* (Weller) may be related to *Plicochonetes ornatus* (Shumard) but certainly not closely. The former has rounded ears and is not similar to the Chouteau species commonly identified as *Chonetes glenparkensis* Weller. The Bushberg species cited by Branson (1938*a*) is not conspecific with the Glen Park species and the latter may be restricted to the Glen Park and its correlatives. To the writer's knowledge all non-Glen Park identifications of *Plicochonetes? glenparkensis* in the literature are incorrect. *Rugosochonetes gregarius* (Weller) was described from a thin oolitic limestone that occurs just above the English River Sandstone at Burlington, Iowa. That thin limestone is probably a Glen Park equivalent as is the upper fossiliferous part of the English River. The other two chonetids, *Rugosochonetes pikensis* n. sp. and *Subglobosochonetes jerseyensis* n. sp., may be restricted to the Glen Park.

Productids.—The productid portion of the brachiopod fauna is diverse and includes 11 species in 11 different genera. Compare this with 16 species in 12 genera of the Chouteau or only seven species in seven genera in the entire McCraney through Wassonville sequence of southeastern Iowa. Four genera are productellids, two of which, *Orbinaria* and *Whidbornella,* indicate strong Devonian affinities. Three genera are leioproductids. Again, two of these, *Mesoplica* and *Nigeroplica,* first appear in the late Famennian in Europe and the Soviet Union. Three avoniid genera are present, one of which, *Sentosia,* is previously known mainly from the Percha Shale of late Famennian age. The linoproductid genus *Ovatia* represents a Carboniferous and Permian lineage. The other genera not discussed here are of Carboniferous aspect. Nine of the 11 productid genera first occur at this horizon in North America.

Pentamerids.—Following Rudwick (1970) I consider the stenoscismataceans to be derived from the pentamerids. One such genus, *Sedenticellula,* occurs here. This rare genus is known only from the Glen Park and Chappel limestones of Kinderhookian age.

Rhynchonellids.—Four genera of rhynchonellids, all of Carboniferous aspect, occur in the Glen Park. The first appearances of *Axiodeaneia* and *Shumardella* are considered significant. Two species of the common Permo-Carboniferous genus *Rhynchopora* in the Glen Park mark the first appearance of this genus at the base of the Carboniferous.

Athyridids.—Four genera are present, three of which have Devonian representatives. Only the *Cardiothyris* is restricted to the Mississippian.

Impunctate spiriferids.—There are eight species in as many genera. The genera *Crurithyris, Tylothyris* and *Parallelora* have late Famennian predecessors but the other five genera have their first occurrence in the Glen Park. The ambocoeliid genus *Eudoxina* and two reticulariacean genera, *Eomartinioposis* and *Kitakamithyris,* first occur here in North America.

Punctate spiriferids.—Two syringothyridid genera

are the only punctate spiriferids in the Glen Park. The genus *Syringothyris* is common in Famennian strata in several continents and is of limited biostratigraphic utility. On the other hand, the new genus *Zeugopleura* may prove to be restricted to the early Kinderhookian Glen Park interval.

Terebratulids.—Three species in three genera of terebratulids occur in the Glen Park. Probably all three mark their first occurrence at the base of the Kinderhookian. Although none of these genera occurs together in younger Kinderhookian formations of the mid-continent all three genera occur together in the Chappel Limestone of central Texas in beds judged to be of very late Kinderhookian age.

PREVIOUS MEGAFOSSIL STUDIES

Weller (1906) first described a portion of the macrofauna of the Glen Park Formation in his paper dealing with the type Glen Park at Glen Park, Jefferson County, Missouri. In 1914, Weller described several additional Glen Park species from the Hamburg oolite of Calhoun County, Illinois. Branson (1938*a*) repeated Weller's descriptions and reillustrated Weller's types but added no new information concerning the biological or geographic extent of the brachiopod fauna. No new Glen Park brachiopod taxa have been described since Weller's studies.

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ACRONYMS

The following acronyms are used in this report: CM, The Carnegie Museum of Natural History; FMNH, the Field Museum of Natural History; UMI, University of Michigan Museum of Paleontology; UI, the University of Illinois; IGS, the Illinois State Geological Survey; UMO, the University of Missouri; and UND, the University of Notre Dame.

STRATIGRAPHIC LOCALITIES (SL)

SL392—*Horton Creek,* Illinois. Glen Park Formation in bluff overhanging south bank of creek. NW ¼, NW ¼, sec. 6, T. 6 S., R. 5 W., Rockport Quad., Pike Co., IL. CM Collection.

SL393—*Brown Branch,* Illinois. Glen Park Formation in bluff above south bank of creek. Basal micritic limestone bed with geodes and conglomeratic clasts at east end of bluff highly fossiliferous. SW ¼, N ½, sec. 26, T. 5 S., R. 6 W., Rockport Quad., Pike Co., IL. IGS and CM collections.

SL394—*Atlas South,* Illinois. Glen Park Formation in hillside above Illinois 96, 2.1 miles southeast of Atlas, IL. Center SE ¼, sec. 35, T. 6 S., R. 5 W., Pleasant Hill West Quad., Pike Co. IL. IGS and CM collections.

SL395—*Hamburg,* Illinois. Oolite bed near top of Glen Park Formation exposed in creekbed and bank of Irish Hollow Creek, behind Methodist Church. NW ¼, SE ¼, sec. 35, T. 9 S., R. 3 W., Hamburg Quad., Calhoun Co., IL. CM collection.

SL396—*Poor Farm Hollow Road,* Illinois. Glen Park Formation in creek bank on south side of Poor Farm Hollow Road, about

1.1 miles west of Illinois 100. SW ¼, NW ¼, sec. 22, T. 10 S., R. 2 W., Hamburg Quad., Calhoun Co., IL. IGS and CM collections.

SL397—*Glen Park,* Missouri. Glen Park Formation from an abandoned quarry (formerly the Goetz Quarry). Center N ½, sec. 5, T. 41 N., R. 6 E., Herculaneum Quad., Jefferson Co., MO. FMNH types and CM collection.

SL511—*Jerseyville Hollow,* Illinois. Glen Park Formation (called Hamburg by collector). SE ¼, sec. 3, T. 6 N., R. 12 W., Grafton Quad., Jersey Co., IL. IGS collection, collected by Tracey Gillette, 1942.

SL520—*Snell Hollow,* Missouri. Glen Park Formation exposed above NW bank of creek. NW ¼, SW ¼, SE ¼, sec. 24, T. 39 N., R. 7 E., Bloomsdale Quad., Ste. Genevieve Co., MO. CM collection.

DEPOSITION OF SPECIMENS

Except for the type specimens borrowed from other museum and university collections, all of the types and referred specimens of this report are deposited at the Illinois State Geological Survey in Champaign, Illinois, or The Carnegie Museum of Natural History, Pittsburgh, Pennsylvania.

SYSTEMATIC PALEONTOLOGY

The suprageneric classification given herein mainly follows that of the Treatise on Invertebrate Paleontology or that of Cooper and Grant (1972–1977). Open nomenclature and synonomies are arranged and marked following the method of Richter (1948), as described by Matthews (1973).

Phylum Brachiopoda Duméril
Class Inarticulata Huxley
Order Lingulida Waagen
Superfamily Lingulacea Menke
Family Lingulidae Menke
Genus ***Lingula*** Bruguière, 1797

Lingula sp.
Fig. 3.1

Remarks.—A single specimen of this genus has been found in the Glen Park. It is a very small single valve, about 7.1 mm long, orientation unknown, from locality SL394.

Order Acrotretida Kuhn
Suborder Acrotretidina Kuhn
Superfamily Acrotretacea Schuchert
Family Discinidae Gray
Subfamily Orbiculoideinae Schuchert
Genus ***Orbiculoidea*** D'Orbigny, 1847

Orbiculoidea sp.
Fig. 3.2–3.4

Remarks.—Five small, rounded inarticulate brachial valves from locality SL393 are assignable to the common genus *Orbiculoidea.* The largest of these shells is nearly circular and about 5.3 mm in maximum dimension. These brachial valves are similar in size and shape to the form described by Moore (1928:262) as *Orbiculoidea hardinensis,* which he recovered from the base of the Hannibal Shale in Calhoun County, Illinois. However, the diagnostic characters of this species are found in the pedicle valve.

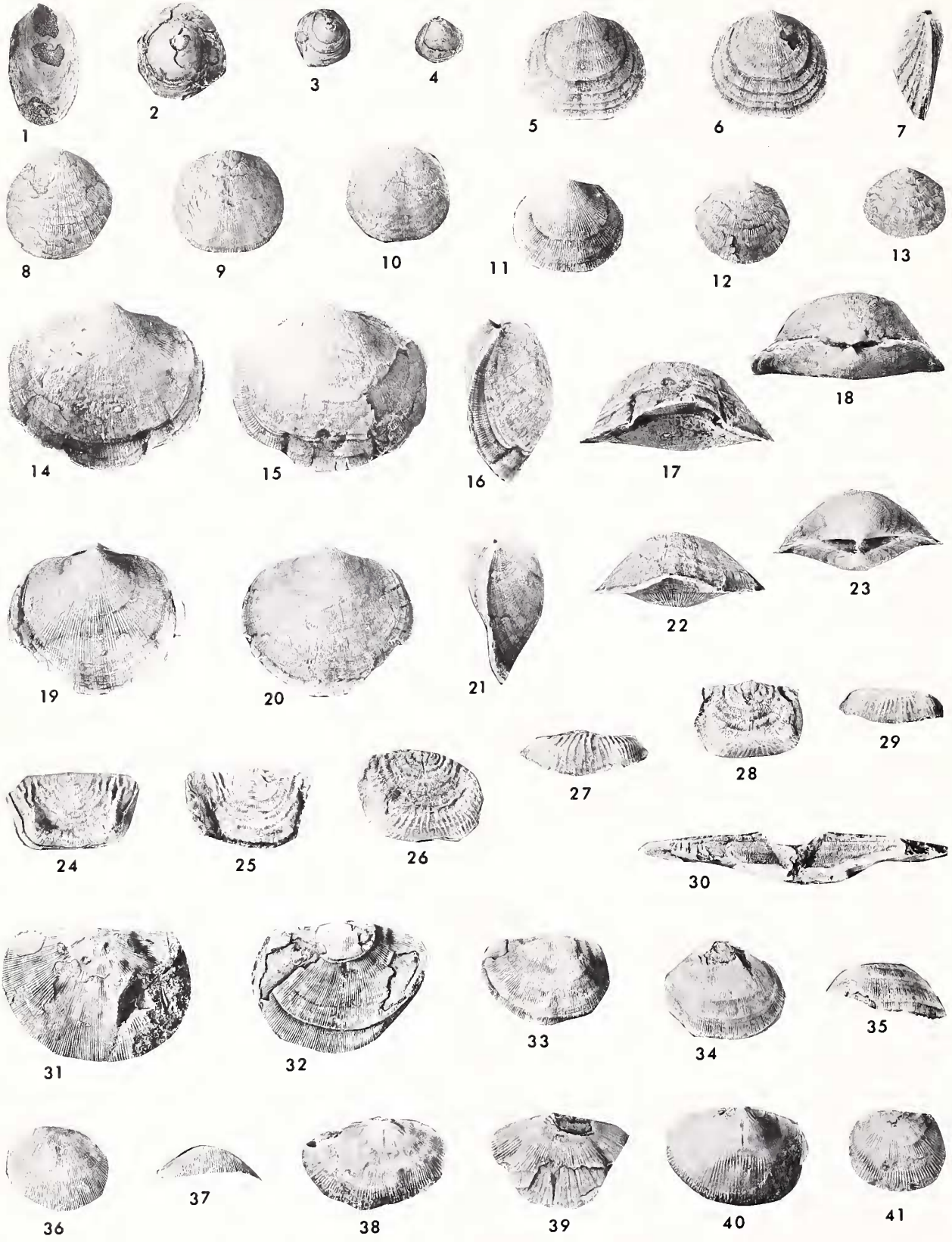
Class Articulata Huxley
Order Enteletida Waagen
Superfamily Rhipidomellacea Alichova
Family Oniellidae Öpik
Genus ***Aulacella*** Schuchert and Cooper, 1931

Aulacella n. sp.
Fig. 5.13–5.15

Remarks.—Five disarticulated incomplete specimens of this Late Devonian genus were recovered from locality SL520 in a southern sandstone facies of the Glen Park Formation, Ste. Genevieve Co., Missouri. Although this species is undoubtedly undescribed, the poor preservation of the few available specimens and lack of interiors prevents proposal of a new taxon.

Assignment to the genus *Aulacella* is based on external characters, including the strong ventral fold, distinct dorsal sulcus, and fascicostellate ornament. It is possible that Weller and St. Clair (1928:161) referred to this species as *Rhipidomella* sp. undesc. in their faunal list from the same locality.

This species is a tiny one; the largest specimen is about 5.2 mm long with a width of about 6.4 mm.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The pedicle valve is strongly arched with nearly flat flanks and the brachial valve is almost planar except for the medial sulcus.

This species is not similar to the several Devonian forms from Iowa and New Mexico described or illustrated by Cooper and Dutro (1982), being much smaller and having a planar brachial valve and more distinctly fasciculate ornament. Nor is it close to the Soviet taxa recently described by Beznosova (1963), Grechishnikova (1966), Bublichenko (1971) and Nalivkin (1979), most of whom refer their taxa to *Aulacella interlineata* (Sowerby), an Upper Devonian species. This Glen Park species is possibly most similar in outline and size to the Pilton shells illustrated by Whidborne (1897:165, pl. 20, fig. 8, 9) as *Orthis* sp., although the finer ribbing in the latter is very poorly indicated in the illustrations and its systematic position is not clear to this writer.

Family Rhipidomellidae Schuchert
Genus ***Rhipidomella*** Oehlert, 1890

Rhipidomella rockportensis, new species
Figs. 3.5–3.13

Holotype.—CM 34618, Fig. 3.5–3.7, collected by the author from locality SL392, April, 1983.

Paratypes.—CM 34619–34623, same collection as the holotype. IGS 80P5 from SL511.

Description.—Medium size for genus, unequally biconvex with brachial valve more inflated than pedicle valve; outline subcircular to transversely subovate with maximum width attained at or slightly anterior to midlength; lateral profile semi-guttate; hingeline narrow, lateral extremities well rounded in all growth stages; anterior commissure nearly rectimarginate to very weakly sulcate, slightly emarginate; fold and sulcus lacking; ornament consisting of numerous fine costellae and strong, irregularly spaced growth varices.

Pedicle valve weakly convex or almost flat in lateral profile, except in umbonal region; beak small, acute, slightly incurved; interarea very small, apsacline, slightly concave; delthyrium broad, nearly forming equilateral triangle with teeth; beak ridges angular, well defined; anterior profile weakly and evenly convex or most convex medially with flattened flanks; no sulcus produced in any specimen at hand; interior not observed.

Brachial valve much more convex than opposite valve, evenly convex to slightly flattened medially, most convex umbonally and anteriorly; anterior profile variable from evenly convex to slightly flattened or with weak sulcus; beak tiny, inconspicuous; interarea much reduced, probably orthocline; fold absent but shallow sulcus in some specimens producing slightly emarginate outline; interior not observed.

Distinguishing characters.—This species is characterized by its flattened or slightly sulcate dorsum, weakly emarginate outline, and evenly convex venter, lacking a ventral sulcus.

Remarks.—*Rhipidomella missouriensis* (Swallow), originally *Orthis missouriensis* Swallow, 1860, was most likely named from the Kinderhookian Chouteau Limestone (Branson, 1938*a*:42). It has commonly been identified in the late Famennian Louisiana Limestone of Missouri and Illinois, and is a junior objective synonym of *Orthis missouriensis* Shumard, 1855, a Silurian impunctate orthid. This Glen Park species is closely similar to the unnamed Chouteau and Louisiana Limestone species and could be conspecific. The Louisiana Limestone specimens examined by the author tend to be more subquadrate and the pedicle valves are slightly flatter medially but these small differences could well be taxonomically unimportant.

The other Chouteau species of *Rhipidomella, R. tenuicostata* Weller, 1914, is not similar to *Rhipidomella rockportensis* n. sp., being more nasute with finer costellae.

Distribution.—This species occurs at the following Glen Park localities: SL392 (42 specimens), SL393 (19 specimens), SL394 (8 specimens), IGS-Gillette Coll. 790, SL 511, Jerseyville Hollow, Jersey County, Illinois (1 specimen). All of these occurrences except the last one are from the non-oolitic silty dolomitic facies.

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Fig. 3.—Inarticulates, punctate orthids, and strophomenids. 3.1, *Lingula* sp., valve unknown, from SL394, ×3, IGS 80P1. 3.2–3.4, *Orbiculoidea* sp., three branchial valves from SL393, ×3, IGS 80P2–80P4. 3.5–3.13, *Rhipidomella rockportensis* n. sp.; 3.5–3.7, ventral, dorsal and lateral views of the holotype from SL392, CM 34618; 3.8–3.10, 3.12, 3.13, three brachial valves and two pedicle valves, respectively, CM 34619–34623 from SL392; 3.11, a pedicle valve from SL511, IGS 80P5, all ×1 except 3.5–3.7, ×1.5. 3.14–3.23, *Schizophoria hortonensis* n. sp., ventral, dorsal, lateral, anterior and posterior views of the holotype (3.14–3.18) and a paratype from SL392, CM 34624, 34625, ×1. 3.24–3.29, *Leptagonia* cf. *L. missouriensis* Carter; 3.24, pedicle valve, IGS 80P6; 3.25, a brachial valve, IGS 80P7; 3.26–3.29, ventral and anterior views of two pedicle valves, CM 34626, 34627, all from SL393, all ×1. 3.31–3.41, *Schuchertella hardinensis* n. sp.; 3.30, 3.32, posterior and ventral views of a pedicle valve from SL396, the holotype, CM 34628, ×2 and ×1, respectively; 3.31, a large pedicle valve from SL396, CM 34629, ×1; 3.33, a brachial valve from SL396, CM 34630, ×1; 3.34–3.37, dorsal and anterior views of two small brachial valves from SL396, CM 34631, 34632, ×1; 3.38, 3.39, a brachial valve and a pedicle valve from SL393, IGS 80P8, 80P9, ×1; 3.40, 3.41, two small brachial valves from SL393, CM 34633, 34634, ×1.5.

Table 3.—*Measurements of types (in mm) of* Rhipidomella rockportensis, *new species.*

Specimen no.	Locality	Length	Width	Thickness
		Holotype		
CM 34618	SL392	13.1	14.5	5.7
		Pedicle valves		
IGS 80P5	SL511	17.2	19.4	4.0
CM 34622	SL392	15.9	17.3	4.2
CM 35623	SL392	13.0	15.2	2.2
		Brachial valves		
CM 34619	SL392	19.6	20.2	6.9
CM 34620	SL392	19.8	19.9	6.3
CM 34621	SL392	17.8	18.6	6.3

Family Enteletidae Waagen
Subfamily Schizophoriinae Schuchert
Genus ***Schizophoria*** King, 1850

Schizophoria hortonensis, new species
Figs. 3.14–3.23

Holotype.—CM 34624, Fig. 3.14–3.18, collected by the author from locality SL392, May 1983.

Paratype.—CM 34625, same collection as the holotype.

Description.—Medium size for genus, dorsibiconvex, transversely subelliptical in outline, greatest width near midlength; lateral profile guttate; hingeline about half of maximum width; cardinal extremities well rounded.

Pedicle valve moderately convex, much thinner than brachial valve, compressed at cardinal extremities, most convex in umbonal region; surface sloping evenly to lateral and anterior margins, becoming almost resupinate in lateral profile in some specimens; umbonal region moderately inflated and moderately broad; shallow, broad sulcus developed in anterior half of valve; beak small and slightly incurved; ventral interarea low, acutely triangular, marked by weak transverse ridges, well defined by subangular beak ridges, moderately concave, apsacline to almost catacline; delthyrium of moderate size, slightly narrower than high; internal details not observed.

Brachial valve much more inflated and convex than pedicle valve, being most convex in umbonal region, surface sloping steeply toward cardinal margin, more evenly towards lateral and anterior margins, becoming slightly compressed towards cardinal margins; umbonal region inflated and projecting well posterior to hingeline; median fold not differentiated; beak tiny, slightly incurved; dorsal interarea concave, very low, apsacline; interior not observed.

Distinguishing characters.—This species can be differentiated by its transversely subelliptical outline, thin pedicle valve, and strongly convex brachial valve, lacking a discernable fold.

Remarks.—The description above is based mainly on the two figured complete but slightly crushed specimens from locality SL392, Pike County, Illinois. The species is moderately common in the silty dolomitic facies along the bluffs of the Mississippi River from Horton Creek to well south of Atlas in Pike County. It is not known to occur in the oolitic facies of the Glen Park. The specimens from the English River Sandstone illustrated by Weller (1914: pl. 21, figs. 33, 34) may belong here but more and better preserved English River specimens are needed to confirm this possible identification.

Table 4.—*Measurements of the types (in mm) of* Schizophoria hortonensis *n. sp. from locality SL392.*

Specimen no.	Length	Width	Thickness
CM 34624	30.4	35.3	18.4
CM 34625	27.1	31.5	14.9

Schizophoria williamsi Rodriguez and Gutschick, 1978, from the Late Famennian Leatham Formation of Utah is similar in size and outline to *Schizophoria hortonensis* n. sp., but differs in having a more inflated pedicle valve, a less inflated brachial valve, and in being somewhat more transverse.

Schizophoria hortonensis n. sp. is most similar to *Schizophoria poststriatula* Weller, 1914, from the Fern Glen Formation of Missouri and the Banff Formation of Alberta. The latter can be distinguished by its more subquadrate outline and better developed sulcus. Weller (1914:167) stated that *poststriatula* lacked a median flattening or sulcus on the brachial valve. However, one of Weller's types (1914:pl. 22, figs. 7–11) clearly has a dorsal median depression and all six specimens of this species collected by the present author have a flattening or slight sulcus in the brachial valve, thus blurring the distinction between *poststriatula* and *Schizophoria swallovi* (Hall).

Distribution.—This description is based on collections from localities SL392 (8 specimens), and SL394 (5 specimens).

Order Strophomenida Öpik
Suborder Strophomenidina Öpik
Superfamily Strophomenacea King
Family Leptaenidae Hall and Clarke
Genus ***Leptagonia*** M'Coy, 1844

Leptagonia missouriensis Carter, 1968
Figs. 3.24–3.29

?1892 *Leptaena rhomboidalis* (Wilckens): Hall and Clarke, pl. 8, fig. 30, 31.
1894 *Plectambonites rhomboidalis* (Wilckens): Keyes, pl. 39, fig. 6.
.1909 *Leptaena rhomboidalis* (Wilckens): Weller, p. 292, pl. 12, fig. 3 (not fig. 2).

.1914 *Leptaena analoga* (Phillips): Weller, p. 49, pl. 2, fig. 3, 4 (not fig. 1, 2, 5–10).
.1938*a* *Leptaena analoga* (Philips) De Koninck: Branson, p. 24–26, 161, pl. 5, fig. 31; pl. 17, fig. 11, 12.
v.1944 *Leptaena analoga* (Phillips): Branson, pl. 31, fig. 11, 12.
.1961 *Leptaena analoga* (Phillips): Nelson, pl. 4, fig. 26.
v*1968 *Leptagonia missouriensis* Carter, p. 1142–1143, pl. 148, fig. 1–14.
v.1987 *Leptagonia missouriensis* Carter: Carter, p. 21, pl. 1, fig. 11–15.

Holotype.—University of Illinois RX-144, from the "white chert" beds of the lower Burlington Limestone at Louisiana, Pike County, Missouri.

Diagnosis.—Small- to medium-sized subquadrate *Leptagonia* with small subangular ears, moderately coarse irregular rugae on the visceral disc of the pedicle valve, a flat or slightly concave dorsal visceral disc, and with the ventral trail distinctly defined by an enlarged ruga.

Remarks.—It now appears that this species first occurs in the Glen Park Limestone and becomes extinct somewhere within the lower Burlington Limestone, ranging throughout the Kinderhookian and early Valmeyeran of the midcontinent. It is readily differentiated from the larger form more commonly referred to *Leptaena analoga* (Phillips) by American authors by its smaller size, small ears, fewer more irregular rugae, and subquadrate outline. The larger species first occurs in the Chouteau Limestone and, like *L. missouriensis,* ranges into the lower Burlington Limestone. Both species occur together in the Fern Glen Formation and lower Burlington Limestone of eastern Missouri.

Brunton (1968:21–31) recently redescribed the type species of *Leptagonia, L. analoga* (Phillips), and rediagnosed the genus as having a prominent pseudospondylium in the pedicle valve and a raised adductor platform in the brachial valve. The latter structure does not seem to be as well developed in North American species of this genus as was illustrated and described by Brunton. Good interiors of Glen Park specimens are not available for study at present.

Distribution.—In the Glen Park Formation this species has been found only at locality SL393 (13 specimens).

Suborder Orthotetidina Waagen
Superfamily Orthotetacea Waagen
Family Schuchertellidae Williams
Subfamily Schuchertellinae Williams
Genus ***Schuchertella*** Girty, 1904

Table 5.—*Measurements (in mm) of the types of* Schuchertella hardinensis, *new species.*

Specimen no.	Locality	Length	Width
		Pedicle valves	
CM 34628	SL396	23.3	31.2
CM 34629	SL396	24.5	±33.4
IGS 80P9	SL393	+17.2	+25.1
		Brachial valves	
CM 34630	SL396	16.0	23.3
CM 34631	SL396	17.5	22.4
CM 34632	SL396	15.1	18.5
IGS 80P8	SL393	16.0	+26.0
CM 34633	SL393	12.2	+16.6
CM 34634	SL393	10.0	11.6

Schuchertella hardinensis, new species
Fig. 3.30–3.41

v.1906 *Orthothetes chemungensis* (Conrad): Weller, p. 440, pl. 6, fig. 5, 6.
v.1914 *Schuchertella* sp.: Weller, pl. 7, fig. 9, 10.

Holotype.—CM 34628, Fig. 3.30, 3.32. Collected by the author at locality SL396, April 1986.

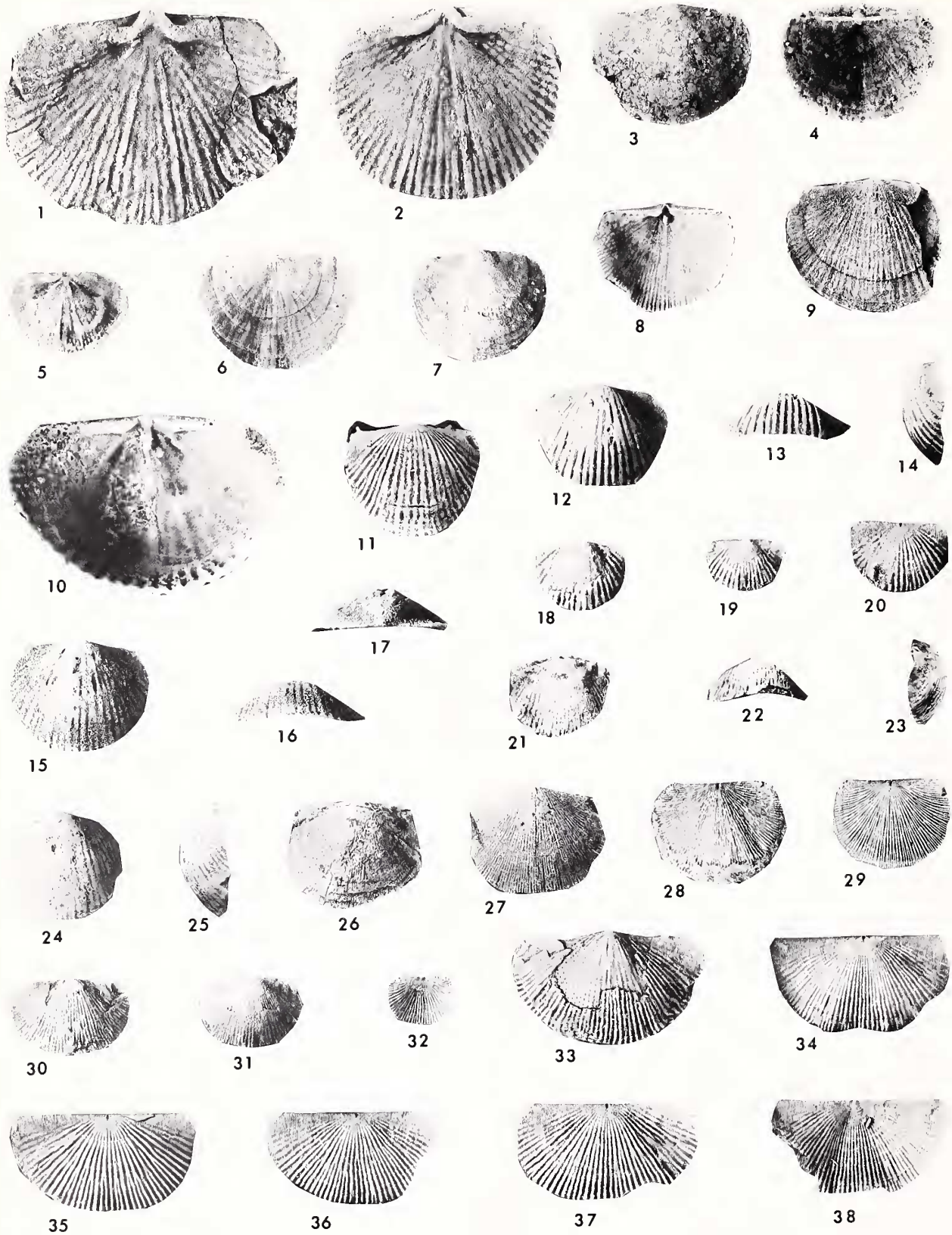
Paratypes.—CM 34629–34632, Fig. 3.31, 3.33–3.37, same collection as the holotype; IGS 80P8, 80P9, from locality SL393, collected by C. Collinson; CM 34633, 34634, from SL393, collected by the author, 1985.

Description.—Medium size for genus, weakly convexo-concave; outline highly variable from transversely subquadrate to almost subelliptical; greatest width usually attained near midlength; body cavity thin to moderately thick; ornament finely and evenly costellate, new costellae randomly added by intercalation in all growth stages in both valves; intercostal furrows with very fine closely and regularly spaced posteriorly convex growth lines; strong growth varices irregularly spaced.

Pedicle valve thin, variable in profile from weakly convex to weakly resupinate; cardinal extremities rounded to slightly subangular; beak very small with no indication of cementation observed; ventral interarea weakly apsacline to almost catacline, low, acutely triangular; pseudodeltidium moderately convex, about as wide as high; dental plates lacking, other internal details not observed.

Brachial valve thicker than pedicle valve, moderately to strongly inflated, often asymmetrical in shape and outline, usually most convex in umbonal region; cardinal extremities rounded; dorsal interarea very low, acutely triangular, anacline; narrow chilidium covering base of low bilobed cardinal process; other internal details not observed.

Distinguishing characters.—This species is characterized by its rounded to slightly subangular cardinal extremities, finely and regularly costellate ornament, and moderately to strongly convex brachial valve.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Remarks.—Weller (1906:440) first assigned specimens of *Schuchertella hardinensis* n. sp. from the type Glen Park to the commonly identified Devonian species, *Schuchertella chemungensis* (Conrad), then (1914:pl. 7, fig. 9, 10) referred to the same specimens as *Schuchertella* sp. The rounded to subangular cardinal extremities and inflated brachial valve serve to distinguish *Schuchertella hardinensis* n. sp. from both the Chemung species and *Schuchertella lens* (White), the type species of the genus, from the Louisiana Limestone.

The brachial valve referred to *Schuchertella rubra* Weller by Branson (1938*a*:161, pl. 17, fig. 26) from the "Bushberg" Sandstone is similar in outline and ornamentation to *Schuchertella hardinensis* n. sp. However, the specimen is almost flat, an unusual condition in any Mississippian orthotetid.

Branson also described a new schellwienellid, *Schellwienella bushbergensis,* based on a single specimen from the same unit, distinguishing it from the other orthotetid specimens in his collection by its serrate ornamentation and inflated umbonal region. This species may prove to belong in the genus *Seratocrista* Brunton, 1968, and its relationship to *Schuchertella hardinensis* n. sp. is unclear. It is much larger than most of the brachial valves from the Glen Park. The unusual serrate costellae of the Bushberg form may reflect superior preservation rather than morphological differences. Unfortunately, additional "Bushberg" specimens from Branson's seemingly lost locality are needed to adequately characterize Branson's species.

Distribution.—This species is fairly common at most Glen Park localities, although good specimens are difficult to obtain. It is conspicuously absent in the typically silty dolomitic facies of Pike County, Illinois, but occurs in small numbers in the micritic limestone at SL393 (6 specimens). In Calhoun County, it occurs commonly in the oolitic facies at SL395 (4 specimens) and SL396 (27 specimens). Two specimens are in the IGS collection from Jerseyville Hollow, Jersey County, and it is very common at the type Glen Park (36 specimens), SL397, Jefferson County, Missouri.

Suborder Chonetidina Muir-Wood
Superfamily Chonetacea Bronn
Family Anopliidae Muir-Wood
Subfamily Tornquistiinae Afanasjeva
Genus ***Subglobosochonetes*** Afanasjeva, 1976

Subglobosochonetes jerseyensis, new species
Fig. 4.1–4.9

v.1906 *Chonetes* sp. undet.: Weller, p. 441, pl. 6, fig. 8–12.
v.1914 *Chonetes* sp.: Weller, pl. 8, fig. 50, 51, 53–55.

Holotype.—Fig. 4.8, CM 34636, collected by the author, April 1986, from SL397, the type section of the Glen Park Formation, Jefferson County, Missouri.

Paratypes.—Fig. 4.1–4.4, 4.9, IGS 80P10–80P13, collected by T. Gillette, 1942, from the "Hamburg" of Jerseyville Hollow, Jersey County, Illinois. Fig. 4.5, 4.6, FMNH UC11354 (4 specimens, not the specimen figured by Weller, 1914, pl. 8, fig. 52, referred here to *Chonetes glenparkensis* Weller); all collected by S. Weller from the Glen Park Formation at the type section, Jefferson County, MO, SL397. Fig. 4.7, CM 34635, collected by the author, April 1986, SL397.

Description.—Medium size for genus, moderately concavo-convex, transversely subovate in outline; maximum width attained at hingeline in subadult specimens, but posterior to mid-length in fully adult specimens with subangular cardinal extremities; ears small, defined by moderately concave flexures on ped-

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Fig. 4.—Chonetids. 4.1–4.9, *Subglobosochonetes jerseyensis* n. sp.; 4.1, 4.2, brachial valve interiors from SL511, IGS 80P10 and 80P11, ×6; 4.3, 4.4, ventral and dorsal views of a complete shell from SL511, IGS 80P12, ×3; 4.5, 4.6, a brachial valve interior and a brachial valve exterior from SL397, FMNH UC11354, ×3; 4.7, a pedicle valve exterior from SL397, CM 34635, ×3; 4.8, the holotype, a pedicle valve interior from SL397 showing hingeline spine distribution, CM 34636, ×3; 4.9, a large pedicle valve from SL511 showing the irregular ribbing, IGS 80P13, ×3. 4.10–4.25, *Plicochonetes? glenparkensis* (Weller); 4.10, 4.15–4.17, interior (×6), ventral, anterior and posterior views of a large pedicle valve topotype from SL397, CM 34637, ×3; 4.11, a large pedicle valve with a pair of hinge spines preserved from SL395, CM 34638, ×3; 4.12–4.14, ventral, anterior and lateral views of the holotype from SL397, FMNH UC11355, ×3; 4.18–4.23, two small pedicle valves, a small brachial valve external mold and three views of a slightly larger pedicle valve from SL392, CM 34639–34642, ×3; 4.24, 4.25, ventral and lateral views of an elongate abraded specimen from SL397, illustrated by Weller as *Chonetes* sp. (1914: pl. 8, fig. 52), FMNH UC11354, ×3. 4.26–4.32, *Rugosochonetes* cf. *C. gregarius* (Weller); 4.26–4.29, two large pedicle valves and molds of two brachial valve exteriors from SL392, CM 34643–34646, ×3; 4.30–4.32, two small pedicle valves and a small brachial valve exterior from SL393, IGS 80P14–80P16, ×3. 4.33–4.38, *Rugosochonetes pikensis* n. sp.; 4.33, a pedicle valve, the holotype, IGS 80P17; 4.34–4.37, four molds of brachial valve exteriors, IGS 80P18–80P21; 4.38, a brachial valve exterior, IGS 80P22, all from SL393, all ×3.

Table 6.—*Measurements (in mm) of the types of* Subglobosochonetes jerseyensis, *new species.*

Specimen no.	Locality	Length	Width	Height
	Pedicle valves			
IGS 80P13	SL511	8.0	±10.6	3.2
IGS 80P12	SL511	7.1	9.4	2.3
CM 34636	SL397	6.8	8.4	1.8
CM 34635	SL397	6.4	8.3	—
	Brachial valves			
IGS 80P10	SL511	6.8	9.0	—
IGS 80P11	SL511	5.9	6.9	—
FMNH UC11354	SL397	6.6	9.3	—
FMNH UC11354	SL397	5.5	7.2	—

Table 7.—*Measurements (in mm) of the types of* Rugosochonetes pikensis, *new species.*

Specimen no.	Locality	Length	Width	Height
	Pedicle valve (holotype)			
IGS 80P17	SL393	6.8	11.1	2.6
	Brachial valves			
IGS 80P18	SL393	5.7	10.7	—
IGS 80P19	SL393	5.8	10.7	—
IGS 80P20	SL393	5.4	9.6	—
IGS 80P21	SL393	5.9	11.0	—
IGS 80P22	SL393	5.6	10.6	—

icle valve and large triangular antero-lateral flattened areas on brachial valve; ornament of both valves consisting of fine capillae which increase by both bifurcation and intercalation, producing an irregularly ribbed appearance (ribbing often obscured by effects of postmortem abrasion); strong growth varices irregularly spaced on both valves; growth lines not observed.

Pedicle valve moderately convex in both lateral and anterior profile, slightly arched medially, most convex in umbonal region; flanks sloping evenly to antero-lateral margins; ears slightly compressed; beak inconspicuous; five pairs of spine bases along cardinal margin in holotype (Fig. 4.8); angle of spines not determined; ventral interarea low, slightly concave, apsacline to nearly orthocline; tiny pseudodeltidium present; interior with short, stout median septum, small broad teeth, five pairs of fine spine perforations under the ventral interarea and directed medially; muscle scars faint and separated by a low median ridge; inner antero-lateral surface capillate reflecting external ornamentation with fine papillae on crests of capillae.

Brachial valve weakly concave, antero-medially flattened at auriculations; dorsal interarea very low, inconspicuous, hypercline; chilidial plates not observed; interior with short bilobed cardinal process supported only by stout inner socket ridges; alveolus moderately developed; anderidea widely divergent, not connected to socket ridges; one prominent pair of accessory septa present with radially arranged endospines coalescing to form several fainter pairs of septa in antero-medial portion of valve; brachial ridges well defined in some specimens (see Fig. 4.5); muscle scars not observed.

Distinguished characters.—This species can be differentiated by its subovate outline, moderate convexity, irregular ribbing consisting of fine capillae that increase by both bifurcation and intercalation on both valves, the maximum width is attained anterior to the hingeline in adult specimens, and five pairs of fine spines.

Remarks.—*Subglobosochonetes jerseyensis* n. sp. is not similar to other chonetid species in the Glen Park Limestone or other Kinderhookian formations in the midcontinent. It is most similar to *Subglobosochonetes norquayensis* Carter, 1987, from the Banff Formation of Alberta of late Kinderhookian age. It differs from the latter in its much less inflated profile and different ribbing patterns. In *Subglobosochonetes jerseyensis* n. sp. the capillae increase by both bifurcation and intercalation in both valves, whereas in *S. norquayensis* the capillae increase by bifurcation in the pedicle valve and by intercalation in the brachial valve.

Subglobosochonetes malevkensis (Sokolskaya), the type species from the Tournaisian of the Soviet Union, has stronger ribbing, is widest at the hingeline, and has fewer spines. Internally, the Soviet species has weaker accessory septa and less divergent anderidea.

Distribution.—This species has been found at the following Glen Park Formation localities: SL397 (17 specimens in CM, 4 specimens FMNH, Weller Coll.); Jerseyville Hollow, Jersey County, IL, Gillette Coll. (16 specimens). Both collections are from the oolitic facies of the Glen Park.

Family Rugosochonetidae Muir-Wood
Subfamily Rugosochonetinae Muir-Wood
Genus ***Rugosochonetes*** Sokolskaya, 1950

Rugosochonetes pikensis, new species
Fig. 4.33–4.38

Holotype.—A pedicle valve, Fig. 4.33, IGS 80P17, collected by C. Collinson from SL393.

Paratypes.—Five brachial valves, Fig. 4.34–4.38, IGS 80P18–80P22, same collection as holotype.

Description.—Small to medium for genus, strongly concavo-convex for genus, much wider than long; outline transversely semicircular to tranversely subquadrate; cardinal extremities subangular to subrounded, greatest width usually attained anterior to hingeline, usually in posterior third of valve; body cavity thin; ornament consisting of about 9–10 sharp, coarse capillae per 3 mm near mid-anterior margin with weak, irregularly spaced growth varices and very fine closely spaced growth lines; capillae increase mainly by bifurcation on both valves, very rarely by intercalation.

Pedicle valve strongly convex, most inflated in umbonal region, medially and evenly arched, ears smooth and delimited by concave flexures, flanks sloping evenly to antero-lateral margins; no sulcus in any specimen observed; beak inconspicuous; cardinal margins straight with two pairs of spine bases, angle of spine inclination not determinable; ventral interarea and interior details not observed.

Brachial valve moderately concave with weak median fold and two weak lateral sulci; cardinal extremities smooth or with very faint capillae; protegulal node narrow and elongate; dorsal interarea, if present, not observed; cardinal proeess small, bilobed; large, deep alveolus present; moderately long, slightly divergent anderidea not attached to cardinal process or inner socket ridges; brachial ridges present but presence of median septum not determinable; endospines radially aligned; other internal details not observed.

Distinguishing characters.—This species is characterized by its strongly capillate ornament, transverse outline with greatest width anterior to the hingeline, inflated evenly convex pedicle valve, moderately concave brachial valve with a weak medial fold and two weak lateral sulci.

Remarks.—Assignment of this new species to the genus *Rugosochonetes* Sokolskaya is based primarily on outline, the strongly capillate ornament, the presence of folding on the brachial valve, and the presence of a large, deep alveolus and brachial ridges in the brachial valve. Few pedicle valves are available for study and the exact number and inclination of the hinge spines is not determinable, nor is the presence of a long median septum in the brachial valve.

Rugosochonetes pikensis n. sp. is not similar to the other three species of chonetids in the Glen Park Formation. In rocks of this age, only *Chonetes alatus* Moore, 1928, from the English River Sandstone and "*Chonetes* bed" of Iowa and northern Illinois is similar in size and ornamentation to *Rugosochonetes pikensis* n. sp. It differs in having an extended hingeline, a weak ventral sulcus, and an evenly concave medial portion of the brachial valve.

Distribution.—This description is based on a single collection of 19 specimens, all disarticulated valves, from locality SL393.

Rugosochonetes cf. ***Chonetes gregarius*** Weller, 1901
Fig. 4.26–4.32

1901 *Chonetes gregarius* Weller, p. 149–150, pl. 12, fig. 2.

Types.—Two syntypes, FMNH UC6654, from Kinderhook Bed 3, Burlington, Iowa, S. Weller Collection.

Referred specimens.—Two pedicle valves and two brachial valves, Fig. 4.26–4.29, CM 34643–34646, from locality SL392, collected by the author; two pedicle valves and one brachial valve, Fig. 4.30–4.32, IGS 80P14–80P16, from locality SL393, collected by C. Collinson.

Table 8.—*Measurements (in mm) of referred specimens of* Rugosochonetes *cf.* Chonetes gregarius *Weller, 1901, from the Glen Park Formation.*

Specimen no.	Locality	Length	Width
	Pedicle valves		
CM 34643	SL392	6.7	8.0
CM 34644	SL392	6.2	8.1
IGS 80P14	SL393	4.6	7.1
IGS 80P15	SL393	4.2	6.1
	Brachial valves		
CM 34645	SL392	6.5	7.8
CM 34646	SL392	5.1	7.1
IGS 80P16	SL393	3.0	4.1

Description of Glen Park specimens.—Small to medium for genus, moderately to strongly concavo-convex, outline semicircular to subquadrate; cardinal extremities subangular with greatest width attained anterior to hingeline, usually in posterior third of valve; body cavity thin; ornament consisting of about 20–23 fine capillae per 3 mm near anterior margin in large specimens, rare coarse growth varices, and regularly spaced growth lines that appear only on crests of capillae giving them crenulate appearance; ribbing increases by bifurcation on pedicle valve and by both bifurcation and more rare intercalation on brachial valve.

Pedicle valve moderately to strongly inflated, most convex medially, flanks evenly convex except for slightly compressed cardinal extremities; beak tiny, inconspicuous; cardinal margins diverging a few degrees from horizontal in large specimens, straight in small specimens; three or more pairs of spines at cardinal margins, inclined at high angle of 60 degrees or more; ventral interarea low, slightly apsacline to almost orthocline; delthyrium and pseudodeltidium not observed; interior not observed.

Brachial valve thin and weakly concave, cardinal extremities slightly flattened and poorly defined by slight flexures; cardinal margins straight, dorsal interarea not observed; small elongate protegulal node well defined; cardinal process small, bilobed with small alveolus; inner socket ridges diverging from hingeline; median septum extending anteriorly to about midlength; anderidea slightly raised; endospines arranged in radial rows; other internal details not observed.

Remarks.—These Glen Park Formation specimens are compared with the poorly known Early Kinderhookian chonetid species *Rugosochonetes gregarius* (Weller), described from "Bed 3"at Burlington, Iowa. "Bed 3" usually consists of two thin beds, the lower one an "impure" limestone with numerous small chonetids, and an upper oolitic bed. It is possible that "Bed 3" is a northern extension of the Glen Park Limestone. In any case the stratigraphic position and lithologic similarity of the two

Table 9.—*Measurements (in mm) of types and referred specimens of* Plicochonetes? glenparkensis *(Weller).*

Specimen no.	Locality	Length	Width	Height
	Pedicle valves			
Holotype				
FMNH UC11355	SL397	6.4	8.0	3.0
CM 34638	SL395	6.7	8.3	2.9
CM 34637	SL397	6.7	8.3	2.6
CM 34639	SL392	4.3	5.5	1.6
CM 34640	SL392	3.1	4.7	1.3
CM 34642	SL392	5.0	6.0	3.0
FMNH UC11354	SL397	6.5	7.2	3.1
	Brachial valve			
CM 34641	SL392	4.2	5.8	—

widely separated units invites comparison of several faunal elements. These Glen Park specimens agree in size, outline, convexity, and general proportions of the Iowa species. The differences between the two are subtle but persistent. The Glen Park specimens have about 20–23 capillae per 3 mm at the anterior margin, and the capillae increase only by means of bifurcation on the pedicle valve. Conversely, the Iowa specimens seem to have slightly finer capillae and the ventral capillae apparently increase both by bifurcation and intercalation. The dorsal interarea of the Iowa species is largely unknown.

Distribution.—*Rugosochonetes* cf. *gregarius* (Weller) has been found at the following localities: SL392 (24 specimens), SL393 (16 specimens), and SL394 (4 specimens).

Subfamily Plicochonetinae Sokolskaya
Genus ***Plicochonetes*** Paeckelmann, 1930

Plicochonetes? glenparkensis (Weller, 1906)
Fig. 4.10–4.25

v*1906 *Chonetes glenparkensis* Weller, p. 441, pl. 6, fig. 7.
v1914 *Chonetes glenparkensis* Weller: Weller, pl. 8, fig. 30 (*not* fig. 47–49).
v.1914 *Chonetes* sp.: Weller, pl. 8, fig. 52.
v.1938*a* *Chonetes ornatus* Shumard: Branson, p. 132, 133, pl. 16, fig. 14.

Holotype.—Fig. 4.12–4.14, FMNH UC11355, collected by S. Weller from SL397.

Description.—Small for genus, strongly concavo-convex with arched venter; outline transversely subovate to almost subcircular in adult specimens, transversely semicircular to transversely subelliptical in immature specimens; cardinal extremities small, subangular to subrounded; greatest width attained anterior to hingeline in posterior third of valve; ornament consisting of about 7–10 fine costellae per 3 mm at anterior margin or total of about 27 to 45 costellae on entire shell (holotype with 7–8 costellae per 3 mm or total of 27 costellae), crossed by fine regular growth lines which give crenulate appearance when spalled or worn; costellae increase by bifurcation on pedicle valve and by both bifurcation and intercalation on brachial valve; costellae becoming very faint or absent at cardinal extremities of both valves.

Pedicle valve strongly convex with arched venter, most convex in umbonal region, sloping evenly to antero-lateral margins; ears small, compressed, delineated by concave flexures; beak small, slightly overhanging hingeline; cardinal margins nearly straight or diverging slightly from horizontal, lacking spines entirely in holotype or with one pair of spines as in Fig. 4.11; angle of spine inclination, when present, not determined; ventral interarea low, orthocline; delthyrium wider than long, partially occluded by small pseudodeltidium; teeth broad; median septum short and stout with low median ridge extending almost to anterior margin; endospines lacking in visceral region, arranged in radial rows near margins and at cardinal extremities; other internal details not observed.

Brachial valve moderately concave with flattened cardinal extremities; small elongate protegulal node present at center of hingeline; interarea not observed; interior not known.

Distinguishing characters.—*Plicochonetes? glenparkensis* (Weller) is characterized by its coarse ornamentation of from about 7–10 fine costellae per 3 mm at the anterior margin, small cardinal extremities, narrow hingeline, poor development (or lack) of spines on the hingeline, and orthocline ventral interarea.

Remarks.—Weller (1914:87–89) interpreted his Glen Park species as being identical with a not very similar chonetid found in the Chouteau Limestone of middle Kinderhookian age. As a consequence, his description and means of differentiating the species was based primarily on Chouteau Limestone specimens.

Weller misinterpreted the rounded cardinal extremities of the holotype to signify that the specimen was abraded and originally much wider in the hingeline than is now seen. He failed to recognize the specimen figured here, Fig. 4.24, as belonging to *Plicochonetes? glenparkensis.* This specimen is probably the one he referred to as a separate chonetid species in his original Glen Park paper (1906: 442). The latter is indeed water worn, but the costellae and growth lines are readily observed under water and indicate that the specimen clearly is assignable to *P. glenparkensis.*

This writer has recently recovered a well preserved pedicle valve, also from the type Glen Park, as illustrated on Fig. 4.15–4.17. This specimen confirms the narrow hingeline, small ears, and lack of hingeline spines seen in the holotype. In addition, a rare specimen of this species was found at locality SL395 in Hamburg, Calhoun County, Illinois. This

well preserved pedicle valve has a pair of hinge spine bases preserved but agrees in every other respect with the holotype and other specimens from the type Glen Park, Jefferson County, Missouri.

Weller's misapplication of the name *glenparkensis* to the Chouteau specimens has resulted in a misunderstanding of the true nature of the species. Unfortunately, his interpretation has been followed by many subsequent workers. The species name has been incorrectly applied to various taxa which are unrelated to *Plicochonetes? glenparkensis* (Weller) from many horizons and localities in North America and the Soviet Union.

Weller (1914:88) suggested that the taxon he interpreted as *Chonetes glenparkensis,* based on the Chouteau specimens, was probably

> . . . most closely allied to *C. logani,* and has sometimes been so identified, but it may be distinguished by its greater size, although some examples of *C. logani* are fully as large as any example of *C. glenparkensis,* by the greater extension of the hinge-line and more conspicuous auriculations of the shell, and by the somewhat coarser costae separated by proportionally wider intercostal furrows.

The present writer pointed out (1968:1144) the likelihood that most Chouteau specimens referred to *Chonetes glenparkensis* should be assigned to *Caenanoplia logani* (Norwood and Pratten).

Branson (1938*a*) mistakenly assigned this species to *Chonetes ornatus* Shumard, assuming that *Plicochonetes? glenparkensis* (Weller) actually included the Chouteau species which have large auriculations.

Plicochonetes? glenparkensis (Weller) is not similar to most other Lower Mississippian North American chonetid species. It can be distinguished from *Plicochonetes ornatus* (Shumard) from the underlying late Famennian Louisiana Limestone by the latter's wider hingeline, larger auriculations, slightly coarser costellae, and intercalation of ribbing on the brachial valve. *Plicochonetes canadensis* Carter, 1987, from the Banff Formation of Alberta has much larger wider auriculations and much finer ribbing than does *Plicochonetes? glenparkensis* (Weller).

Assignment of *Chonetes glenparkensis* Weller to the genus *Plicochonetes* Paeckelmann is tentative because this genus presumably is partially characterized by large auriculations (Muir-Wood, 1962: 82) and a septum in both valves. *Plicochonetes? glenparkensis* (Weller) has small auriculations in mature specimens, although they are relatively much larger compared to the visceral disc in immature speeimens. Furthermore the presence of a dorsal median septum has not been demonstrated in *Plicochonetes? glenparkensis* (Weller).

Distribution.—This species is extremely rare at the topotype locality, SL397. Weller's collections contain the holotype and the other Weller specimen figured here (Fig. 4.24), both pedicle valves. Despite extensive collecting at this locality this writer found only one other specimen, the pedicle valve illustrated here as Fig. 4.15–4.17. Six pedicle valves were collected by the writer at SL395, in Hamburg, Calhoun County, Illinois, from the so-called Hamburg Oolite. These specimens are authentic in every respect and compare closely with the holotype. Several collections of much smaller specimens are provisionally assigned to this species: SL392 (6 specimens), SL393 (23 specimens), SL394 (2 specimens), and an IGS collection from Gresham Hollow (3 specimens). If all of these collections are correctly identified, the species is present, but rare, over nearly the entire area of distribution of the Glen Park Formation.

Suborder Productidina Waagen
Superfamily Productacea Gray
Family Productellidae Schuchert
Subfamily Productellinae Schuchert
Genus ***Orbinaria*** Muir-Wood and Cooper, 1960

Orbinaria? brownensis, new species
Fig. 6.11–6.16

Holotype.—A pedicle valve, Fig. 6.11–6.12, IGS 80P27, collected by C. Collinson from locality SL393, Pike County, Illinois.

Paratypes.—Fig. 6.13–6.16, IGS 80P28–80P30, same collection as the holotype.

Description.—Small for genus, moderately concavo-convex, length-width ratio variable but usually wider than long in larger shells; body cavity thin; cardinal extremities subangular to subrounded; outline transversely subquadrate to subovate; hingeline slightly shorter than greatest width, which is usually attained at about midlength; cardinal extremities forming small auriculations.

Pedicle valve moderately convex, greatest convexity in umbonal region; venter slightly arched, flanks sloping evenly to antero-lateral margins; auriculations moderately well defined by concave flexures, slightly compressed; beak small, slightly overhanging hingeline, with small cicatrix on some specimens; ornament consisting of numerous irregular rugae and numerous scattered slightly elongate spine ridges which may be crudely arranged in quincunx in some specimens; growth lines sinuous, irregular, slightly lamellose; spines very fine, probably nearly erect, occurring at anterior terminations of spine ridges and slightly more densely on auriculations and near hingeline; interarea, if present, not observed; internal details not observed.

Brachial valve moderately and evenly concave except at car-

Table 10.—*Measurements (in mm) of the types of* Orbinaria? brownensis, *new species.*

Specimen no.	Locality	Length	Width	Height
	Pedicle valves			
IGS 80P27	SL393	9.9	13.3	3.8
IGS 80P28	SL393	8.5	9.0	2.5
IGS 80P29	SL393	5.2	7.8	2.4
	Brachial valve			
IGS 80P30	SL393	7.7	9.3	—

dinal extremities which are delimited by slightly flattened or convex flexures; conspicuous small round protegulal node present at center of hingeline; ornament similar and complementary to that of opposite valve except that rounded dimples reflect elongate spine ridges of pedicle valve and fine spines are very rare; interior not observed.

Distinguishing characters.—This species is characterized by its small size, transversely subquadrate to subovate outline, elongate spine ridges which may be crudely arranged in quincunx on the pedicle valve, and rounded dimples in the brachial valve.

Remarks.—*Orbinaria? brownensis* n. sp. is tentatively assigned to the genus *Orbinaria* Muir-Wood and Cooper on the basis of its external shape and ornamentation. However, there are some significant differences between this new species and *Orbinaria pyxidata* (Hall), the type species from the Louisiana Limestone. *Orbinaria pyxidata* is much larger, much more inflated, lacks a cicatrix, and has a distinct row of spines at the hingeline. In addition, the dorsal dimples are elongate, not rounded, and Muir-Wood and Cooper (1960:149) state that dorsal spines are lacking, although there do seem to be fine spines on Plate 35, figure 10 of their book.

Distribution.—This description is based on a single collection of 16 specimens from locality SL393.

Subfamily Chonopectinae Muir-Wood and Cooper

Ruthiphiala, new genus
Fig. 5.1–5.12, 6.1–6.10

Type species.—*Pustula bushbergensis* Branson, 1938, from the "Bushberg Sandstone" of Montgomery County, Missouri, of early Kinderhookian age.

Other assigned species.—*Productella sublaevis* Weller, 1914, originally described from the English River Sandstone Member of the Hannibal Formation at Kinderhook, Pike County, Illinois. Specimens of this species from the Glen Park Formation, SL393, are described below.

Table 11.—*Measurements (in mm) of the types of* Ruthiphiala sublaevis *(Weller, 1914).*

Specimen no.	Locality	Length	Width	Height
	Pedicle valves			
Lectotype				
FMNH UC10558	Kinderhook, Illinois	25.6	34.0	9.0
IGS 80P25	SL393	21.6	29.5	4.8
	Brachial valves			
Paralectotype				
FMNH UC10558	Kinderhook, Illinois	32.7	41.4	10.7
IGS 80P23	SL393	29.8	37.9	10.1
IGS 80P24	SL393	26.7	32.3	7.3
IGS 80P26	SL393	24.3	32.5	5.0

Derivation of name.—Ruth, a woman's name, from the latin *phiala,* a saucer or bowl.

Diagnosis.—medium sized moderately concavo-convex chonopectinids with weakly expressed ornamentation consisting only of fine elongate spine ridges, crudely arranged in quincunx, bearing very fine prostrate spines at their anterior terminations, a row of coarse laterally inclined spines on the ventral hingeline, and very fine sinuous growth lines; spines seemingly lacking on brachial valve; cicatrix very small; ventral interarea short and orthocline, dorsal interarea very short, possibly lacking in some specimens, nearly catacline; dorsal interior with moderately large erect bilobed cardinal process, large deep alveolus, short thin median septum, very fine endospines, tiny sockets, and lacking brachial ridges.

Comparisons.—*Ruthiphiala* differs from most other chonopectinid genera in its lack of concentric rugose ornamentation. In this respect it is most similar to the genera *Chonopectus* Hall and Clarke, 1893, and *Acanthatia* Muir-Wood and Cooper, 1960. *Ruthiphiala* differs from *Chonopectus* in having numerous spine ridges and fine prostrate spines on the pedicle valve, whereas *Chonopectus* lacks ventral spines except at the hingeline. *Ruthiphiala* is most similar to the Late Devonian genus *Acanthatia* and can be differentiated by its elongate spine ridges and fine prostrate spines on the pedicle valve and its laterally directed hinge spines. *Acanthatia* lacks elongate spine ridges and has more numerous and higher angled hinge spines.

Stratigraphic range.—As presently known this genus seems to be confined to rocks of earliest Carboniferous age.

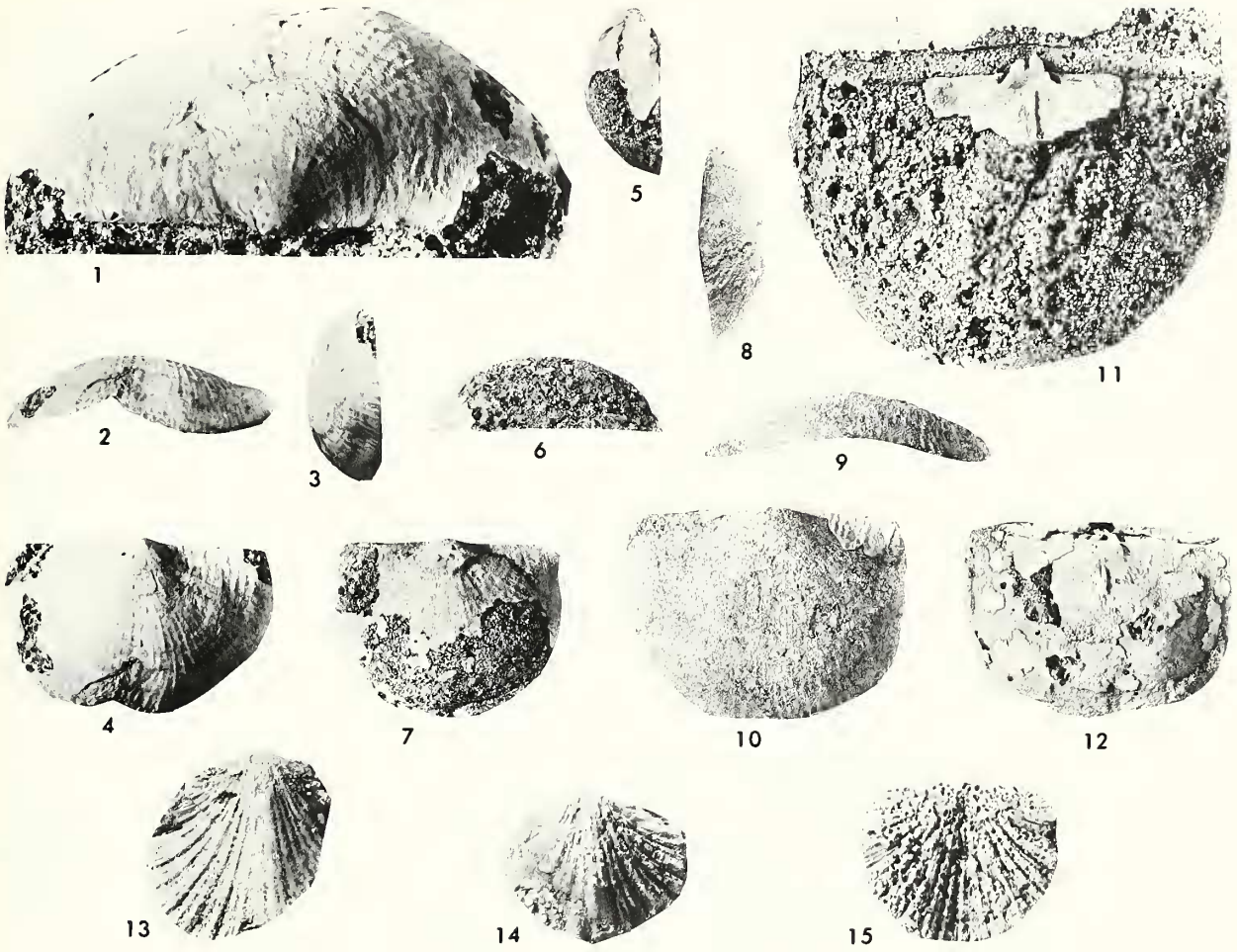


Fig. 5.—Productids and punctate orthids. *Ruthiphiala bushbergensis* (Branson), type specimens; 5.1–5.4, posterior (×2), anterior, lateral and ventral views of the lectotype, UMO 4253; 5.5–5.10, lateral anterior and ventral views of two pedicle valves, paralectotypes UMO 4253 and UMO 3864, respectively; 5.11, mold of brachial valve exterior showing impression of ventral interarea and with cardinalia still preserved, paralectotype UMO 4253; 5.12, nearly complete brachial valve interior, paralectotype UMO 4253; all ×1 except 5.1 and 5.11, ×2; all from "Bushberg" Sandstone float, 7 miles west of Montgomery City, Missouri, collected by E. B. Branson. 5.13–5.15, *Aulacella* n. sp., two pedicle valves and a brachial valve from SL520, CM 34752–34754, all ×5.

Ruthiphiala sublaevis (Weller, 1914)
Fig. 6.1–6.10

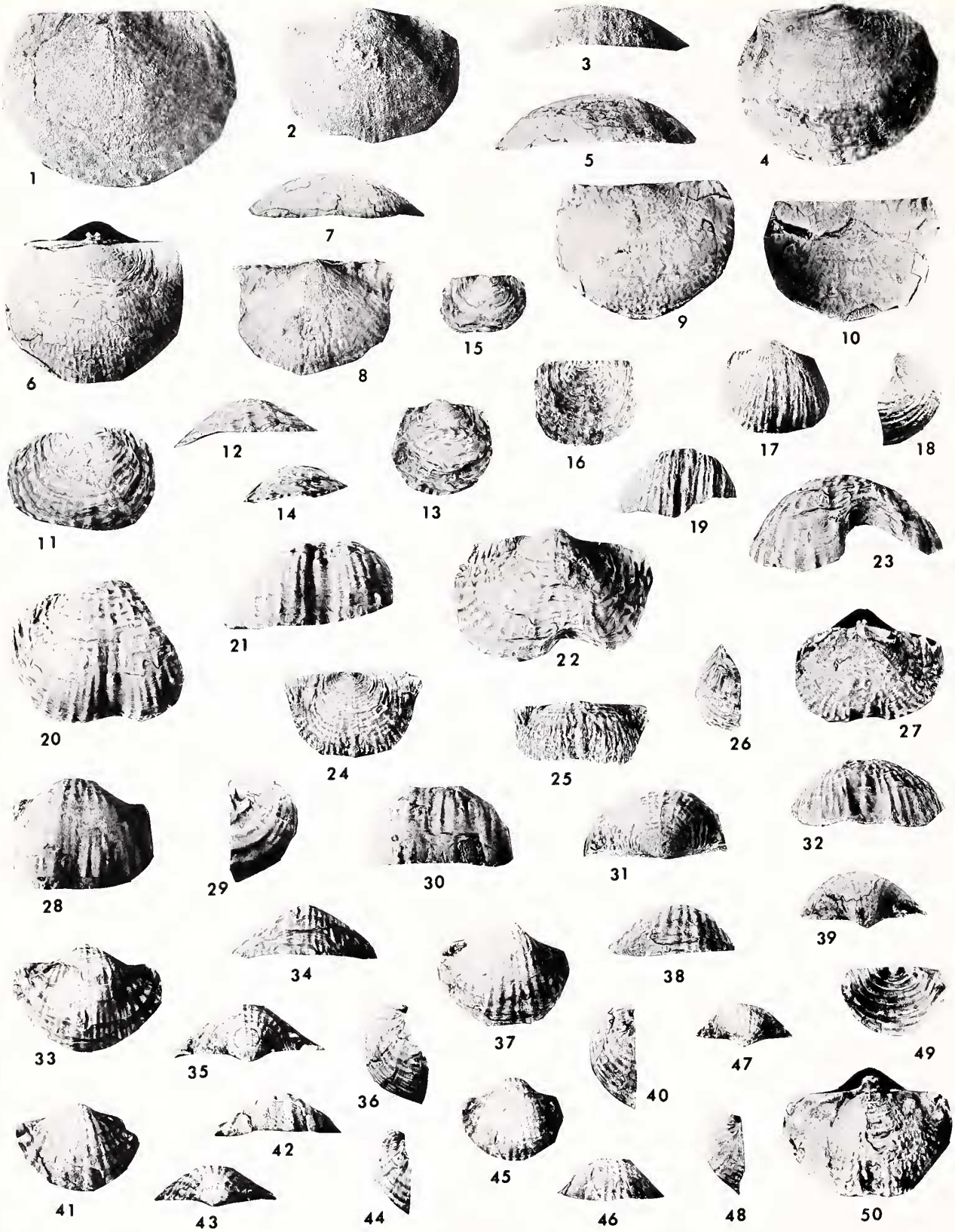
v*1914 *Productella sublaevis* Weller, p. 102–103, pl. 83, fig. 18–20.

Lectotype.—Designated herein, FMNH UC10558, figured by Weller (1914:plate 83, fig. 18, a pedicle valve), from the English River Sandstone at Kinderhook, Pike County, Illinois.

Paralectotypes.—Three specimens, all numbered FMNH UC10558, two specimens figured by Weller (1914:plate 83, fig. 19, a natural cast of a brachial valve interior; fig. 20, a natural mold of a brachial valve exterior). Same collection as the lectotype.

Description.—Medium size for subfamily, semicircular to subovate in outline, wider than long, moderately concavo-convex, non-geniculate; greatest width in adults usually attained at about midlength but immature specimens may reach greatest width at hingeline; auriculations of moderate size, cardinal extremities subangular, delimited by broadly concave flexures; fold and sulcus not developed.

Pedicle valve evenly and moderately convex in both lateral and anterior profile, being most convex near the small beak which projects very slightly beyond hingeline; flanks spreading evenly to antero-lateral margins; interarea not observed; ornament consisting of elongate spine bases over entire valve surface, roughly arranged in quincunx, with very fine spines at anterior terminations of ridges, and with several pairs of coarse hinge spines laterally directed at high angle to hingeline; interior with short median ridge near hingeline and large, radially ridged, moderately impressed ventral muscle field.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Brachial valve moderately and evenly concave except for flattened cardinal extremities which are set off by slightly convex flexures, producing thin body cavity; interarea not observed; ornament similar to that of pedicle valve but spines not observed; interior with moderate sized erect bilobed cardinal process with conspicuous alveolus; other internal details not observed.

Distinguishing characters.—This species can be distinguished by its semicircular to subovate outline, relatively narrow hingeline, and short spine ridges arranged in quincunx.

Remarks.—The description of the type speeies for the genus, *Ruthiphiala bushbergensis* (Branson), was apparently based on only four specimens, two pedicle valve exteriors and two brachial valve interiors. A large pedicle valve, hereby designated the lectotype (Fig. 5.1–5.4), possesses very long spine ridges with fine terminal spine bases. Branson's other figured pedicle valve (Fig. 5.5–5.7) has a nearly complete hingeline preserved with sharply bent dorsally directed lateral auriculations that are smaller but otherwise similar to those seen in the strophalosiid genus *Cyphotalosia* Carter, 1967. The hingeline in this specimen also approximates the maximum width, as do the two brachial valves in the type suite (Fig. 5.11, 5.12). Branson (1938*a*:165) expressed doubts about his species' validity, stating that it might prove to be conspecific with *Ruthiphiala sublaevis* (Weller). Although there is some doubt concerning the exact stratigraphic horizon of Branson's "Bushberg Sandstone," it seems prudent to consider the two names to represent separate taxa because of the morphological differences cited above. The "Bushberg" species is chosen as type species because of the superior preservation of the brachial valve interiors, well preserved exterior ornamention of the pedicle valve, and clear indication of a ventral interarea.

Distribution.—Weller's types came from the lowest Hannibal Formation unit at Kinderhook, Pike County, Illinois, considered by Moore (1928:21) to be the English River Sandstone Member of the Hannibal. The Glen Park Limestone collection is from SL393, also from Pike County, Illinois, and comprises ten specimens.

Genus ***Whidbornella*** Reed, 1943
Whidbornella curtirostra (Winchell, 1865)
Fig. 8.18–8.39

v*1865 *Producta curtirostra* Winchell, p. 114.
1914 *Productus curtirostris* Winchell: Weller, p. 130–131, pl. 14, fig. 8–13.

Lectotype.—Designated herein, a pedicle valve, Fig. 8.18, UMI 1337, White Collection, from the English River Sandstone at Burlington, Iowa.

Paralectotypes.—A natural mold of a brachial valve exterior, Fig. 8.19, 8.20, UMI 1337, from the same collection as the lectotype. Unfigured small slab with a pedicle valve exterior and a natural mold of a brachial valve exterior, UMI 1337, same collection as the lectotype.

Description.—Medium size for genus, moderately concavo-convex; transversely subovate to almost circular in outline; maximum width variable in position from hingeline to mid-length; lateral profile semichordate to subguttate; ears small, subangular, moderately defined, slightly compressed; geniculation poorly developed or not detectable; trails short to moderate; body cavity thin.

Pedicle valve most convex in posterior third of valve, usually near anterior portion of visceral disc, much less convex on trail and flanks; umbonal region broad, very little inflated, produced

←

Fig. 6.—Productids. 6.1–6.10, *Ruthiphiala sublaevis* (Weller); 6.1, a natural cast of a brachial valve interior, paralectotype FMNH UC 10558, from the English River Sandstone at Kinderhook, Illinois, Weller Collection; 6.2, 6.3, ventral and anterior views of the lectotype, a pedicle valve, FMNH UC10558, same collection; 6.4–6.7, anterior and ventral views of two natural molds of brachial valve exteriors from SL393 with small amounts of shell matter preserved near the hingeline, showing some of cardinalia, IGS 80P23, 80P24; 6.8, a small pedicle valve from SL393 showing hinge spines, IGS 80P25; 6.9, 6.10, natural mold and exterior of brachial valve from SL393, IGS 80P26, all ×1. 6.11–6.16, *Orbinaria? brownensis* n. sp.; 6.11, 6.12, ventral and anterior views of the holotype, a pedicle valve, IGS 80P27; 6.13, 6.14, ventral and anterior views of a paratype, a pedicle valve, IGS 80P28; 6.15, a small pedicle valve paratype with cicatrix, IGS 80P29; 6.16, a brachial valve exterior paratype, IGS 80P30; all ×2. 6.17–6.32, *Mesoplica? mesicostalis* (Weller); 6.17–6.19, ventral, lateral and anterior views of the lectotype, FMNH UC10585, from the English River Sandstone at Burlington, Iowa, ×1; 6.20–6.23, ventral and anterior views of two pedicle valves from SL393, CM 34647, 34648, ×1.5 (note superior preservation of ornament and pathological deformation of shell in 6.22); 6.24–6.26, dorsal, anterior and lateral views of natural mold of brachial valve exterior from SL393, IGS 80P31, ×1; 6.27, 6.32, dorsal and anterior views of spalled brachial valve interior with cardinal process preserved from SL393, IGS 80P32, ×1; 6.28–6.31, ventral, lateral, posterior and anterior views of a nearly complete pedicle valve from SL393, IGS 80P33, ×1. 6.33–6.50, *Argentiproductus auriculatus* n. sp.; 6.33–6.48, ventral, anterior, posterior and lateral views of four pedicle valves including the holotype, CM 34649 (6.33–6.36) and three paratypes from SL393, CM 34650, 34651 (6.37–6.40, 6.45–6.48), IGS 80P34 (6.41–6.44); 6.49, small brachial valve exterior showing dorsal ornament, IGS 80P35; 6.50, partially spalled brachial valve interior showing cardinal process, IGS 80P36; all from SL393; all ×2 except 6.49, ×4, and 6.50, ×3.

Table 12.—*Measurements (in mm) of types and referred specimens of* Whidbornella curtirostris *(Winchell).*

Specimen no.	Locality	Length	Width	Height	Surface measure
		Pedicle valves			
Lectotype					
UMI 1337	Iowa	25.2	27.7	10.4	31.8
Paralectotype					
UMI 1337	Iowa	19.1	23.8	7.2	22.3
Referred specimens					
IGS 80P41	SL393	27.0	+31.2	11.6	38.0
IGS 80P42	SL393	20.4	25.2	9.6	28.7
IGS 80P43	SL393	20.8	25.3	9.5	29.7
CM 34667	SL393	19.0	25.2	8.9	27.4
		Brachial valves			
Paralectotype					
UMI 1337	Iowa	24.3	+31.5	13.0	33.8
Paralectotype					
UMI 1337	Iowa	17.8	20.2	6.6	19.1
Referred specimens					
CM 34668	SL393	19.9	+26.0	7.7	24.7
IGS 80P44	SL393	24.8	25.8	7.7	31.5

only slightly beyond hingeline; sides of auriculations sharply bent dorsad in lectotype but much less so in paralectotype; beak small; venter evenly convex or slightly arched medially; interarea not observed; visceral disc ornamented with numerous weak irregular rugae best developed on sides of umbonal region, and numerous fine elongate longitudinal spine ridges arranged in quincunx; growth lines very fine and sinuous; anterior to visceral disc spine ridges become much more elongate, simulating irregular costae in some specimens; fine suberect spine bases sparsely scattered on crests of spine ridges, more densely spaced and more or less concentrically arranged near antero-lateral margins; single row of laterally directed fine spines at hingeline; interior with numerous longitudinally arranged fine endospines; muscle field slightly impressed; low ridges forming ear baffles preserved on some specimens; other internal details not observed.

Brachial valve strongly and evenly concave except for ears which are defined by slightly convex flexures, and trail which may be weakly concave or slightly geniculate; dorsal interarea not observed; ornament consisting of numerous weak narrow rugae and numerous fine elongate dimples arranged in quincunx on visceral disc; dimples on trail tend to become much elongated and coalescing to form irregular costae complementary to those of opposite valve; spines apparently lacking; growth lines similar to those of pedicle valve; interior with small sessile bilobed cardinal process with large alveolus, supported by short lateral ridges diverging from hingeline; small elongate antero-laterally directed sockets present on each side of cardinal process; other internal details not observed.

Distinguishing characters.—This species is characterized by its thin body cavity, concentric rugae, and strong radial ornamentation of numerous elongate spine ridges, arranged in quincunx on the visceral disc, that become much elongated anteriorly forming irregular costae on the trail. Internally, the cardinal process has a large alveolus and there are low ridges forming ear baffles in the pedicle valve.

Remarks.—Winchell's types are in the C. E. White Collection at the University of Michigan, UMI 1337, and are from the English River Sandstone at Burlington, Iowa. These specimens are preserved in soft sandstone and lack many taxonomically important morphological characters, such as a good indication of spine distribution and internal details. However, the very close similarity between Winchell's types and the Glen Park collection from locality SL393 leaves little doubt about the specific identity of the two collections. This, in turn, allows a new generic assignment based on the dorsal interiors of the Glen Park specimens.

There are no North American species comparable to *Whidbornella curtirostra* (Winchell). The type species, *Whidbornella caperata* (J. de C. Sowerby), from the Late Devonian of England, as illustrated by Muir-Wood and Cooper (1960:pl. 34, fig. 17–22) and discussed by Reed (1943:71–74), appears to have finer more deeply impressed rugae, weaker less regularly arranged elongate spine ridges on the visceral disc, and the dorsal valve visceral disc is flattened, not evenly and strongly concave as in *Whidbornella curtirostra* (Winchell, 1865).

Distribution.—This species is rare in the English River Sandstone from which it was described. In the Glen Park Formation it occurs only at locality SL393 (60 specimens).

Genus ***Quadratia*** Muir-Wood and Cooper, 1960

Quadratia? sp.

Fig. 8.46

Remarks.—This is the only productoid specimen found by the author at the type section of the Glen Park Formation in Jefferson County, Missouri. It is a small transverse natural mold of a brachial valve. This unique specimen is in no way similar to any other Glen Park productoid, having a flattened visceral disc covered with numerous fine rugae, a few scattered shallow weak dimples, and sinuous growth lines. The postero-medial region is depressed and more strongly convex (concave in a positive sense) and the lateral extremities are weakly reflexed, defining flattened auriculations.

Assignment of this specimen proved to be a perplexing problem, due to a paucity of morphological

information. The shape and ornamentation of this specimen are similar to those found in at least three Early Carboniferous productoid genera, all proposed by Muir-Wood and Cooper in 1960, namely *Quadratia, Geniculifera,* and *Rhytiophora. Geniculifera* was rejected as a likely assignment because both valves of that genus tend to be nasute. *Rhytiophora* was rejected because the brachial valves tend to have longer trails and more numerous dorsal dimples. Finally, *Quadratia* has sinuous growth lines similar to those of this specimen, although many productoid genera share this character. Assignment to the genus *Quadratia* is clearly not certain and may have to be revised if more specimens come to light.

Measurements (in mm).—CM 34669, from SL397, length 9.1; width 13.9; height 2.1.

Table 13.—*Measurements (in mm) of types and referred specimens of* Mesoplica? mesicostalis *(Weller, 1914).*

Specimen no.	Locality	Length	Width	Height
	Pedicle valves			
Lectotype				
FMNH UC10585	Iowa	17.1	21.5	11.3
Paralectotypes				
FMNH UC10585	Iowa	18.4	22.8	11.5
FMNH UC10585	Iowa	18.5	+23.3	11.5
FMNH UC10585	Iowa	18.4	20.5	13.7
FMNH UC10585	Iowa	19.6	20.1	14.4
IGS 80P33	SL393	19.9	26.1	12.4
CM 34647	SL393	17.0	±25.8	9.4
CM 34648	SL393	16.9	24.5	7.9
	Brachial valves			
FMNH UC10585	Iowa	17.7	21.9	8.4
IGS 80P31	SL393	15.5	25.4	7.5

Family Leioproductidae Muir-Wood and Cooper
Subfamily Leioproductinae Muir-Wood and Cooper
Genus ***Mesoplica*** Reed, 1943

Mesoplica? mesicostalis (Weller, 1914)
Fig. 6.17–6.32

v*1914 *Productus mesicostalis* Weller, p. 114, pl. 11, fig. 12–16.

Lectotype.—Designated herein, a pedicle valve, FMNH UC10585, figured by Weller (1914:plate 11, fig. 13–15), from the English River Sandstone at Maple Hill, Washington County, Iowa. Figured herein, Fig. 6.17–6.19.

Paralectotypes.—FMNH UC10585, 6 specimens, 2 figured (Weller, 1914:plate 11, fig. 12, a pedicle valve; fig. 16, an incomplete brachial valve interior), same collection as the lectotype.

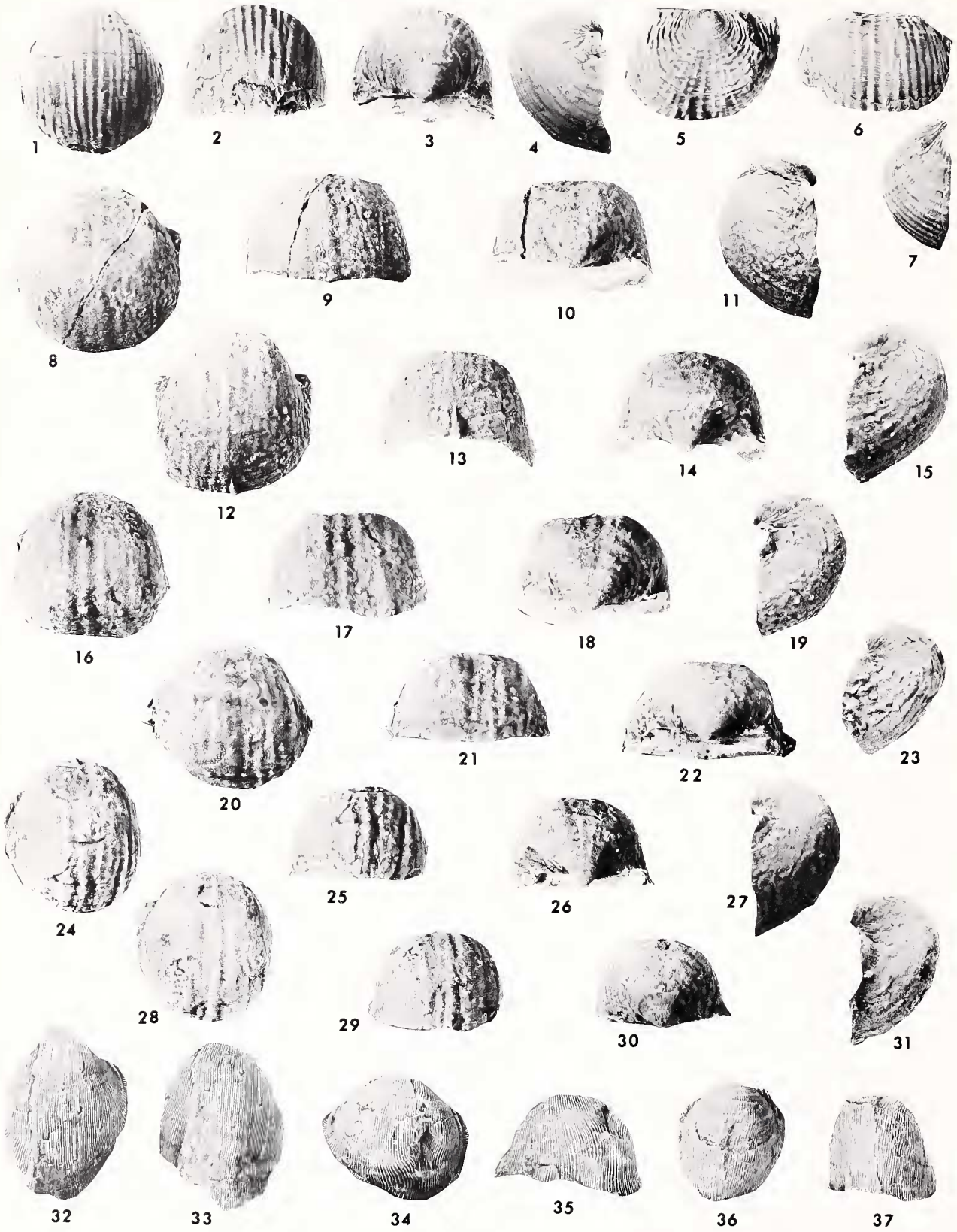
Description.—Medium size for family, strongly concavo-convex, transversely subovate to subquadrate in outline; greatest width usually attained anterior to hingeline, often at about mid-length, but specimens with large auriculations may be widest at hingeline; cardinal extremities subangular to subrounded; lateral profile almost semicircular; anterior profile semiovate to subtrapezoidal; body cavity moderately thick; shell substance thin.

Pedicle valve strongly inflated, most convex in umbonal region, otherwise almost evenly curved in profile with flanks dropping steeply to antero-lateral margins, not geniculate; beak small, slightly incurved, umbonal region moderately inflated, extending well posterior to hingeline; small to medium sized auriculations defined by concave flexures; venter flattened anterior to umbonal region, then forming shallow sulcus on trail; ornamentation on visceral disc consisting of weak irregular rugae and narrow elongate quincuncially arranged spine ridges, latter forming irregular costae on trail; sulcus usually with distinctive medial costa larger than those on flanks; spine bases erect, moderately stout, scattered on spine ridges, on auriculations, and near hingeline, those on median costa being larger in diameter than those elsewhere; interior not observed.

Brachial valve moderately to deeply concave, least concave in visceral disc, sloping steeply to antero-lateral margins, some specimens geniculate; cardinal extremities moderately large in some specimens, well defined by strongly convex flexures; low fold formed on trail; ornamentation complementary to that of opposite valve but lacking spines; median costa represented by strong median furrow and elongate spine ridges are represented by elongate dimples; small protegulal node present medially at hingeline; cardinal process sessile, small, bilobed internally, supported by very stout median septum that extends forward over much of visceral disc; endospines coarse, radially arranged; other internal details not observed.

Distinguishing characters.—This species can be differentiated by its strongly inflated pedicle valve, evenly convex semicircular lateral profile, moderate fold and sulcus with medial ventral costa and dorsal medial furrow, rugose ventral visceral disc with elongated spine ridges, costate trails, scattered finer spines on the flanks, ears, and hingeline, and several coarse spines on the median costa of the pedicle valve.

Remarks.—*Mesoplica? mesicostalis* (Weller) is not similar to other North American Mississippian leioproductids. It bears some resemblance in shape and outline to several Devonian species belonging to this family but can be differentiated from them by its costate ornamentation. *Mesoplica praelonga* (J. de C. Sowerby), the type species of the genus from the Famennian of England, differs in being larger, in having a weaker sulcus, and in having weaker, more indistinct costae which extend onto the visceral disc. *Mesoplica praelonga simplicior* (Whidborne) from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the Famennian of England lacks a ventral sulcus, the median costa is weak or absent, and the costae extend onto the visceral disc. *Mesoplica praelonga semisbugensis* (Nalivkin) from the Famennian of Kazakhstan is larger than *Mesoplica? mesicostalis* (Weller), has very coarse costae, and a strong medial costa in the sulcus.

Distribution.—Weller described this species from the English River Sandstone of Washington County, Iowa. His collection of syntypes comprises only seven specimens, all indifferently preserved in soft sandstone. Van Tuyl (1925:56) reported this species in the English River Sandstone at Burlington, Des Moines County, Iowa.

In the Glen Park Formation *Mesoplica? mesicostalis* (Weller) occurs only at locality SL393, Pike County, Illinois (30 specimens).

Genus ***Nigeroplica*** Nalivkin, 1975

Nigeroplica? illinoisensis, new species
Fig. 7.1–7.31

Holotype.—Fig. 7.16–7.19, CM 34656, locality SL392, collected by the author, April 1985.

Paratypes.—Fig. 7.1–7.15, 7.20–7.31, CM 34652–34659, same collection as the holotype.

Description.—Medium size for genus, strongly concavo-convex, length and width subequal or more often longer than wide; greatest width attained anteriorly on trail or, more rarely, at hingeline; outline variable from longitudinally to transversely subovate to subquadrate; lateral profile semicircular to subguttate; auriculations small, well defined, subangular, compressed; both valves geniculate; trail moderately long in most specimens; body cavity thick; shell substance thin.

Pedicle valve strongly inflated, most convex in umbonal region and at point of geniculation; visceral dise more moderately convex; flanks sloping steeply to antero-lateral margins, trail weakly convex to almost straight in profile; venter variable in convexity from evenly convex to flattened or sulcate; sulcus weakly developed or lacking; anterior profile often subquadrate; umbo broad, beak small, slightly overhanging hingeline; ornament consisting of weak rugae and faint elongate spine ridges on posterior portion of visceral disc, ridges forming irregular costae anteriorly on visceral disc and trail; large median costa often present but absent in some specimens; lateral costae of variable strength and uniformity, sometimes merging, bifurcating or becoming obsolete on trail; suberect moderate diameter spines numerous over most of shell, often on crests of costae, being especially dense on lateral extremities, those near hingeline being slightly finer; several large diameter erect spines on median costa, when present; growth lines fine, sinuous; internal details not observed.

Table 14.—*Measurements (in mm) of the types of* Nigeroplica? illinoisensis, *new species.*

Specimen no.	Locality	Length	Width	Height	Surface measure
		Pedicle valves			
CM 34652	SL392	18.2	17.8	12.1	35.0
CM 34654	SL392	19.8	19.9	12.5	36.5
CM 34655	SL392	19.7	19.3	13.2	36.2
CM 34656	SL392	17.9	18.7	12.0	34.5
CM 34657	SL392	18.0	19.3	11.0	31.9
CM 34658	SL392	19.0	16.7	10.7	35.6
CM 34659	SL392	18.3	15.8	10.8	34.1
		Brachial valve			
CM 34653	SL392	15.6	19.1	7.8	—

Brachial valve strongly geniculated with weakly concave visceral disc, being strongly concave at point of geniculation, moderately concave on trail; trail moderately long; ears set off by weakly convex flexures; tiny protegulal node present at posteromedial margin; ornament consisting of rugae and elongate dimples on entire visceral disc and costae on trail; spines not observed; deep wide median intercostal furrow present on trail of most specimens; cardinal process small, sessile, bilobed internally, with small alveolus, supported by long median septum that extends forward almost to point of geniculation; other internal details not observed.

Distinguishing characters.—*Nigeroplica? illinoisensis* n. sp. can be recognized by its small size, geniculate valves, subquadrate anterior profile, ornamentation of rugae and spine ridges on the ventral visceral disc with costae on the trail, large median costa on most specimens, and numerous medium-sized erect spines over much of the pedicle valve, several large erect spines on the median costa, and with a deep, wide medial intercostal furrow on the trail of the brachial valve in many specimens.

Remarks.—Assignment of this species to the genus *Nigeroplica* Nalivkin, 1975, is based almost entirely on external morphology and ornamentation and comparison is made mainly with Soviet illustrations of the type species. The interior of the type species of this genus, *Productus niger* Gosselet, 1888, is not well known, nor is that of the present species from the Glen Park. Nalivkin (1975:160) originally

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Fig. 7.—Productids. 7.1–7.31, *Nigeroplica? illinoisensis* n. sp.; 7.1–7.7, small pedicle valve and small natural mold of brachial valve exterior with very well preserved ornament, CM 34652, 34653; 7.8–7.31, six pedicle valves, including the holotype (7.16–7.19), CM 34654–34659, all from SL392; all ×1.5. 7.32–7.37, *Ovatia nascens* n. sp.; 7.32, 7.33, ventral and anterior views of a pedicle valve, the holotype, CM 34660; 7.34–7.37, ventral and anterior views of two natural molds of brachial valve exteriors, CM 34661, 34662, all from SL392, all ×1.

assigned his new genus to the Family Avoniidae Sarycheva, 1960, but stated that it was one of the last representatives of the group of *Mesoplica praelonga* (J. de C. Sowerby). Later (1979:46), he reassigned it to the Family Leioproductidae Muir-Wood and Cooper, 1960, reaffirmed its similarity to *Mesoplica,* and compared it with the leioproductid genus *Argentiproductus* Cooper and Muir-Wood, 1951, and the overtoniid genus *Avonia* Thomas, 1914. These genera are not related and have radically different dorsal interiors. It is possible that *Nigeroplica* is a junior subjective synonym of the genus *Spinocarinifera* Roberts, 1971.

In North America, *Nigeroplica? illinoisensis* n. sp. is most similar to *Productus missouriensis* Branson, 1938, which may prove to be assignable to the genus *Nigeroplica.* Branson (1938*a*:163–164) based his species on six specimens from the "Bushberg Sandstone" of Montgomery County, Missouri. These specimens are all much larger than *Nigeroplica? illinoisensis* n. sp. and five of the six specimens are strongly transverse with a definite fold-sulcus, a rare occurrence in *Nigeroplica? illinoisensis* n. sp. In addition, the "Bushberg" species seems to lack the large medial costa with strong erect spines that characterize the Glen Park form.

Spinocarinifera copiosa Carter, 1987, from the Banff Formation of Alberta, is similar to *Nigeroplica? illinoisensis* n. sp. in its size, outline, profile, and ornamentation, excluding spine distribution. It differs in having a much longer trail, a flattened venter in many specimens, a much narrower hingeline, and a dense brush of spines on the lateral extremities.

Nigeroplica niger (Gosselet), the type species, from the late Famennian and early Tournaisian of Eurasia, differs from *Nigeroplica? illinoisensis* n. sp. in having an evenly convex non-geniculate lateral profile, and the common development of a flattened venter or sulcus. A strong median costa with coarse erect spines is not developed in specimens from Belgium.

Productus (Avonia) schindewolfi Paeckelmann, 1931, from the Late Famennian or Early Tournaisian of Germany is similar to *Nigeroplica? illinoisensis* n. sp. in outline and geniculate lateral profile, and in the possession of a strong median costa with several strong erect coarse spines. It differs in having smaller auriculations, weaker ribbing on the flanks, and a more convex rounded anterior profile.

Distribution.—*Nigeroplica? illinoisensis* n. sp. has been found only at locality SL392, Pike County, Illinois (44 specimens).

Subfamily Productininae Muir-Wood and Cooper
Genus ***Argentiproductus*** Cooper and Muir-Wood, 1951

Argentiproductus auriculatus, new species
Fig. 6.33–6.50

Holotype.—A pedicle valve, Fig. 6.33–6.36, CM 34649, collected by the author at SL393, 1985.

Paratypes.—A pedicle valve, Fig. 6.37–6.40, IGS 80P34, collected by C. Collinson; two pedicle valves, CM 34650, 34651, Fig. 6.41–6.48, collected by the author in 1985; a brachial valve exterior, Fig. 6.49, IGS 80P35, collected by C. Collinson; an imperfect brachial valve interior, IGS 80P36, collected by C. Collinson; all from SL393.

Description.—Small for the genus, moderately concavo-convex, much wider than long, greatest width attained at or near hingeline; outline tranversely subelliptical; body cavity thin.

Pedicle valve moderately inflated with broad umbonal region most strongly convex and projecting notably beyond hingeline; lateral profile subguttate to semicircular, slightly geniculate in large specimens; anterior profile slightly arched medially with gently convex flanks sloping gradually to antero-lateral margins; cardinal extremities extended into moderately large, slightly compressed auriculations well delimited by concave flexures; beak moderately large, incurved over hingeline; ornamentation consisting of squamous growth lamellae and four to six, coarse to medium, mostly simple, rounded costellae per 3 mm at the anterior margin, which infrequently increase by bifurcation; intercostal furrows narrow; spine bases erect or suberect and coarse for size of specimens, rare on venter and flanks, with one pair on sides of umbo, and two pairs on auriculations; interior with moderately impressed ventral muscle field and strongly developed ear baffles that are not externally apparent.

Brachial valve moderately to deeply concave, with short trail; small protegulal node present at hingeline; cardinal extremities delimited by slightly convex flexures; ornamentation consisting only of regularly lamellose growth lamellae in small specimens, exterior of large specimens not observed; interior with small sessile trilobed cardinal process; lateral ridges diverging moderately from hingeline, not reaching auriculations; length of median septum not observed; endospines numerous, becoming coarse anteriorly; trail much thickened with secondary shell tissue, with depressed medial sulcus bordered by rows of strong endospines; brachial ridges and other internal details not observed.

Distinguishing characters.—*Argentiproductus auriculatus* n. sp. is characterized by its small size, tranverse outline, large auriculations, medium to coarse costellae, ear baffles in the pedicle valve, and much thickened dorsal trail.

Remarks.—*Argentiproductus auriculatus* n. sp. is not similar to other North American productininines, being much more transverse and lower in profile than such common species as *Productina sampsoni* (Weller) or *Productina parvula* (Winchell). *Productina lodgepolensis* Rodriguez and Gutschick,

from the Lodgepole Limestone of Montana, is similar in being transverse with the greatest width at the hingeline and in having a low profile, but differs in being proportionately narrower, having much smaller auriculations, and much finer ribbing.

Argentiproductus margaritacea (Phillips), the type species from the Viséan of northern Europe and Australia, differs from *Argentiproductus auriculatus* n. sp. in being much larger with relatively smaller auriculations. *Argentiproductus rjausakensis* Nalivkin, from the late Famennian of the southern Urals, is very similar in outline and costation to *Argentiproductus auriculatus* n. sp. but differs in being somewhat larger with more acutely triangular auriculations. Spine patterns and the presence or absence of ear baffles in the pedicle valve are not known for the Soviet species.

Distribution.—This description is based on single collections of 24 specimens, all from locality SL393, Brown Branch, Pike County, Illinois.

Table 15.—*Measurements (in mm) of the types of* Argentiproductus auriculatus, *new species, all from locality SL393.*

Specimen no.	Length	Width	Height	Surface measure
		Pedicle valves		
CM 34649	9.8	13.7	5.3	16.0
IGS 80P34	9.3	11.8	4.6	14.3
CM 34650	8.0	11.2	4.3	11.3
CM 34651	7.6	9.5	3.5	11.0
		Brachial valves		
IGS 80P35	3.2	5.0	—	—
IGS 80P36	8.0	10.4	3.1	—

Family Overtoniidae Muir-Wood and Cooper
Subfamily Sentosiinae Nalivkin
Genus ***Sentosia*** Muir-Wood and Cooper, 1960

Sentosia? ignota, new species
Fig. 8.1–8.17

Holotype.—A pedicle valve, Fig. 8.7–8.10, CM 34665, collected by the author from SL393.

Paratypes.—Pedicle valve, Fig. 8.1, CM 34663, same collection as the holotype; pedicle valve, Fig. 2, IGS 80P37, collected by C. Collinson; pedicle valve, Fig. 8.3–8.6, CM 34664, same collection as the holotype; pedicle valve, Fig. 8.11–8.14, IGS 80P38, collected by C. Collinson; natural mold of brachial valve exterior with cardinal process preserved at hingeline, Fig. 8.15, CM 34666, same collection as the holotype; natural mold of brachial valve exterior with eardinal process preserved, Fig. 8.16, IGS 80P39, collected by C. Collinson; small natural mold of brachial valve exterior, Fig. 8.17, IGS 80P40, collected by C. Collinson. All specimens are from Brown Branch, Pike County, Illinois, locality SL393.

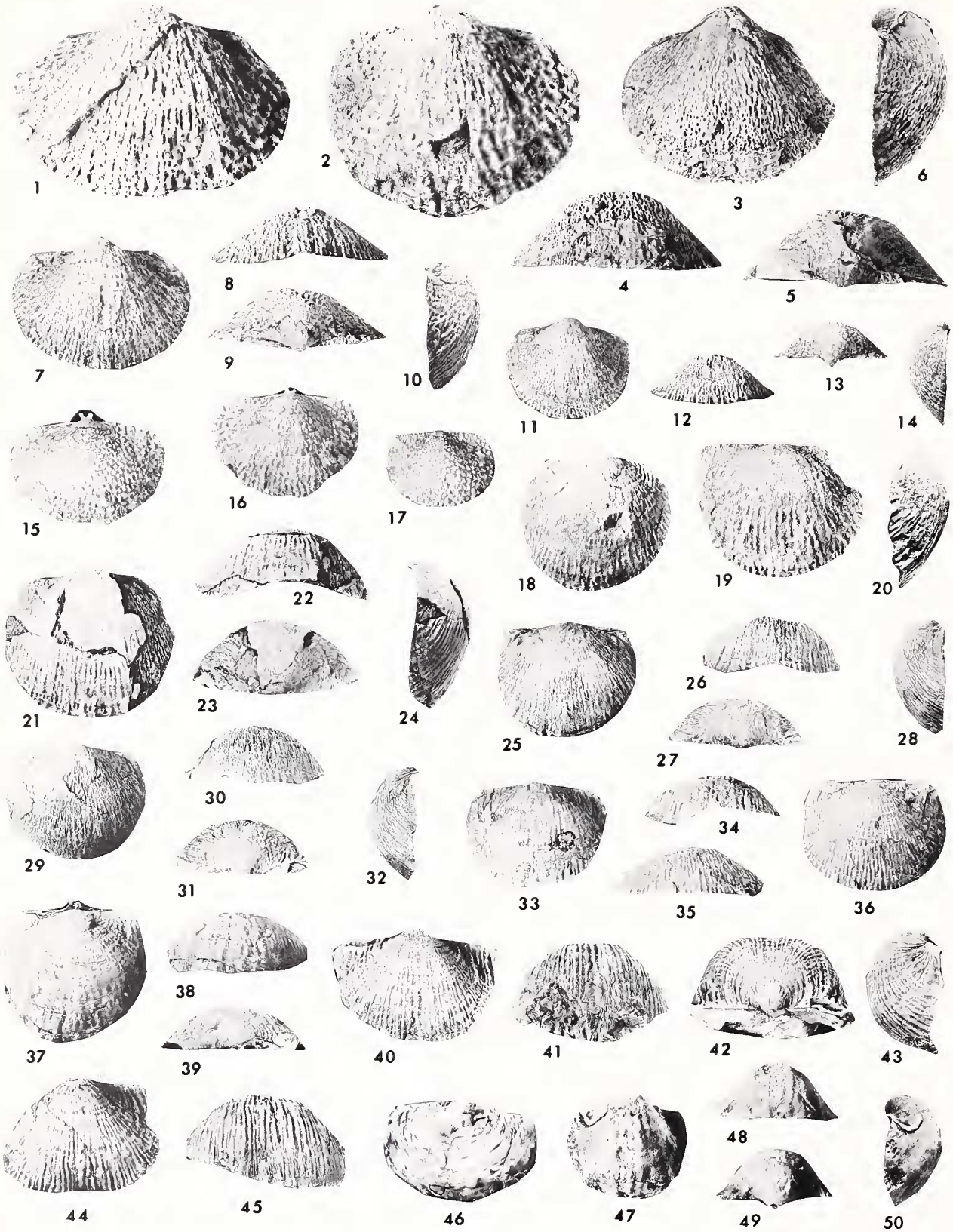
Description.—Medium size for genus, moderately concavo-convex, transversely subelliptical in outline, wider than long; maximum width attained near midlength; fold and sulcus lacking; lateral profile low, semilenticular to semichordate; auriculations moderately developed, well rounded, delimited by concave flexures; trail short, body cavity thin.

Pedicle valve moderately inflated, most convex in umbonal region, evenly convex on venter, weakly convex on flanks, ears moderately eompressed; anterior profile semiprolate; umbonal region moderately inflated, posteriorly produced, overhanging hingeline; beak small, incurved; ornament consisting of numerous closely spaced, elongate spine ridges, arranged in quincunx, sometimes coalescing to form irregular costellae on venter, especially anteriorly; weak irregular rugae present, mostly on umbonal region; growth lines very fine, regularly spaced, sinuous; spine bases round and relatively coarse, that is, almost as thick as spine ridges, present on each spine ridge and distributed almost evenly over entire valve surface; inclination of spines not determinable; interior with numerous densely spaced endospines and moderately impressed muscle field.

Brachial valve moderately and evenly coneave except for postero-medial depression and cardinal extremities which are defined by low, slightly convex flexures; ornament consisting of slightly elongate dimples arranged in quincunx, very weak irregular rugae, and fine regularly spaced sinuous growth lines; spine bases very fine, sparsely scattered; interior with small sessile bilobed cardinal process; lateral ridges short, diverging slightly from hingeline; endospines very long and fine anteriorly, densely arranged on trail; other internal details not observed.

Distinguishing characters.—This species is characterized by its transversely subelliptical outline, moderately arched venter with flattened or weakly convex flanks, and ornamentation of elongate spine ridges arranged in quincunx that tend to coalesce anteriorly on the pedicle valve and slightly elongate dimples arranged in quincunx on the brachial valve.

Remarks.—*Sentosia? ignota* n. sp. is not similar to other North American productids. Its unusual ornamentation of elongated spine ridges arranged in quincunx over the whole pedicle valve and tending to coalesce into irregular costae is reminiscent of the genus *Rhytiophora* Muir-Wood and Cooper, 1960. The latter genus, however, is much more convex with a much broader umbo, has coarser ornamentation with strongly rugose valves, and well developed angular auriculations. Assignment of this species to the genus *Sentosia* Muir-Wood and Cooper is speculative and based upon similarity in shape, outline, degree of inflation, and general pattern of ornamentation. This new Glen Park species differs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from the Famennian type species, *Sentosia praesursor* (Stainbrook), in having much coarser ornamentation. Furthermore, the type species has a flattened venter and much less arched anterior profile. The interior of the Glen Park species is poorly known. For these reasons, assignment of this new species to the genus *Sentosia* is not certain.

Sentosia kysarkensis Nalivkin, 1979, from the Famennian of the southern Urals bears some similarity to *Sentosia? ignota* n. sp. in its ornamentation on both valves, but the Soviet species appears to be much more elongated with subangular auriculations. *Productus* (*Waagenoconcha*) *nurensis* Nalivkin, as described and illustrated by Litvinovich et al. (1975), from the Lower Tournaisian of Kazakhstan, is similar to *Sentosia? ignota* n. sp. in outline and general type of ornamentation but differs in being much larger with weaker ribbing on the ventral trail.

Distribution.—This description is based on a single collection of 15 specimens from locality SL393, Brown Branch, Pike County, Illinois.

Table 16.—*Measurements (in mm) of the types of* Sentosia? ignota, *new species, all from locality SL393.*

Specimen no.	Length	Width	Height	Surface measure
		Pedicle valves		
CM 34663	11.6	16.7	6.0	16.0
IGS 80P37	12.6	15.5	4.8	16.7
CM 35664	21.4	+25.7	10.0	31.2
CM 34665	15.8	21.5	7.4	22.4
IGS 80P38	12.1	14.9	5.8	16.4
		Brachial valves		
CM 34666	13.5	18.6	3.6	—
IGS 80P39	13.1	18.2	3.6	—
IGS 80P40	9.2	13.1	2.9	—

Subfamily Overtoniinae Muir-Wood and Cooper
Genus ***Avonia*** Thomas, 1914

Avonia sp.
Fig. 8.47–8.50

Referred specimen.—A small spalled pedicle valve, IGS 80P47, collected by C. Collinson from SL393, Brown Branch, Pike County, Illinois.

Description.—This description is based on a single pedicle valve. Smaller than average for genus, strongly convex, slightly wider than long, outline transversely subovate; maximum width attained anterior to hingeline near midlength; lateral profile semichordate to subguttate; ears moderately large, well defined, compressed; umbonal region inflated, moderately narrow, extending well posterior to hingeline; beak small, narrow, overhanging hingeline; venter arched with almost triangular anterior profile; flanks weakly convex, sloping steeply to lateral margins; trail short; ornament poorly preserved due to spalling of surficial shell layers but consisting of at least several relatively coarse simple rounded costellae on venter; spine bases poorly preserved but at least one pair of relatively coarse erect spine bases present on sides of umbo; other details not observed.

Measurements (in mm).—Length, 6.5; width, 7.3; height, 3.6; surface measure, 9.3.

Remarks.—This unique specimen is quite different from any other productid in the Glen Park Formation by virtue of its narrow inflated umbo and weakly costellate ornament. Assignment to the common Lower Carboniferous genus *Avonia* Thomas is based on its small size, subovate outline, arched venter, inflated narrow umbo with an incurved beak, and weakly costellate ornamentation. The writer is unaware of any comparable species in North America.

Genus ***Semiproductus*** Bublichenko, 1956

Semiproductus sp.
Fig. 8.40–8.45

Referred specimens.—Two pedicle valves, IGS 80P45, 80P46, collected by C. Collinson from Brown Branch, Pike County, Illinois, locality SL393.

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Fig. 8.—Productids. 8.1–8.17, *Sentosia? ignota* n. sp.; 8.1, 8.2, two small pedicle valves showing spine base distribution, CM 34663 and IGS 80P37, respectively; 8.3–8.14, ventral, anterior, posterior and lateral views of three pedicle valves, including the holotype (8.7–8.10), CM 34664, 34665 and IGS 80P38, respectively; 8.15, 8.16, two spalled brachial valve interiors with cardinal process preserved, CM 34666 and IGS 80P39, respectively; 8.17, natural mold of brachial valve exterior, IGS 80P40, all from SL393; all ×1.5 except 8.1 and 8.2, ×3. 8.18–8.39, *Whidbornella curtirostris* (Winchell); 8.18, the lectotype, UMI 1337, a pedicle valve from the English River Sandstone at Burlington, Iowa; 8.19, 8.20, ventral and lateral views of the natural mold of a brachial valve, a paralectotype, UMI 1337, same locality as the lectotype, both from White Collection; 8.21–8.35, ventral, anterior, posterior and lateral views of four pedicle valves, IGS 80P41–80P43, CM 34667, respectively; 8.36, natural mold of a brachial valve exterior, CM 34668; 8.37–8.39, spalled brachial valve interior showing cardinal process, IGS 80P44, 8.21–8.39 all from SL393; all ×1. 8.40–8.45, *Semiproductus* sp.; 8.40–8.43, ventral, anterior, posterior and lateral views of a nearly complete pedicle valve, IGS 80P45; 8.44, 8.45, ventral and anterior views of an incomplete pedicle valve, IGS 80P46; both from SL393; ×1. 8.46, *Quadratia?* sp., a spalled brachial valve exterior from SL397, CM 34669, ×1. 8.47–8.50, *Avonia* sp., ventral, anterior, posterior and lateral views of a pedicle valve from SL393, IGS 80P47, ×3.

Table 17.—*Measurements (in mm) of referred specimens of* Semiproductus *sp. from locality SL393.*

Specimen no.	Length	Width	Height	Surface measure
IGS 80P45	22.6	30.3	13.7	39.0
IGS 80P46	22.3	+30.0	15.1	+36.0

Description.—Average size for genus, strongly convex, much wider than long, outline transversely subquadrate; greatest width attained at hingeline; auriculations moderately large, compressed, subangular; umbo broad, not inflated, moderately produced posteriorly; beak small, slightly overhanging hingeline; visceral disc flattened, moderately convex; lateral profile geniculate; anterior profile subtrapezoidal; venter of visceral disc flattened, trail with shallow but distinct sulcus on both specimens; flanks sloping steeply to lateral margins; trail short but specimens may be incomplete; reticulate ornamentation consisting of numerous moderately coarse rugae and weak spine ridges in umbonal region, rugae and costae on remainder of visceral disc; well developed costae present on trail; costae numbering about 10 or 11 per cm at anterior margin; spine bases rare on trail and flanks, usually with two strong bases on costa in center of sulcus; spine bases more numerous near hingeline and sides of umbo, not seemingly arranged in any consistent pattern; brachial valve, depth of body cavity, and interiors unknown.

Remarks.—Authentic large reticulate productids are unreported in the late Famennian and earliest Mississippian of North America. Assignment of these pedicle valves to the Soviet genus *Semiproductus* Bublichenko is based solely on external morphological characters. The Glen Park specimens differ from pedicle valves of the type species, *Semiproductus minax* Bublichenko, 1956, mainly in having stronger radial ornamentation. In this respect, the Glen Park specimens most closely resemble *Semiproductus speluncus* Nalivkin, 1979, from the late Famennian of the southern Urals. The latter can be readily differentiated from the Glen Park species by its much larger size, broader sulcus and much coarser ornamentation.

Family Linoproductidae Stehli
Subfamily Linoproductinae Stehli
Genus ***Ovatia*** Muir-Wood and Cooper, 1960

Ovatia nascens, new species
Fig. 7.32–7.37

.1914 *Productus ovatus* Hall: Weller, pl. 16, fig. 13; not fig. 1–12, 14, 15.

Holotype.—A pedicle valve, Fig. 7.32–7.33, CM 34660, collected by the author from SL392, May 1984.

Paratypes.—Two natural molds of brachial valve exteriors, Fig. 7.34–7.37, CM 34661, 34662, same collection as the holotype.

Description.—Average size for genus, strongly gibbous, longer than wide with maximum width attained near midlength; outline subovate; ears small, subangular, well defined by concave flexures, much compressed; brachial valve slightly geniculated; body cavity thin.

Pedicle valve strongly convex, most convex in umbonal region, becoming much less convex anteriorly; narrow gibbous umbonal region extending posterior to hingeline; beak narrow, incurved, overhanging hingeline; flanks sloping steeply to lateral margins; venter evenly rounded, anterior profile almost U-shaped; trail moderately long, usually flaring moderately; entire surface costellate with about 25–27 costellae per cm as measured 25 mm from ventral beak (surface measure); costellae increase by intercalation except by bifurcation anterior to spine bases; six or seven strong rounded rugae present on each side of umbonal region and on ears but not extending around umbo; growth lines very fine, closely spaced, irregular in strength; fine spine bases sparsely and almost evenly scattered on crests of costellae over entire surface of valve; hinge spine bases not observed; internal details not observed.

Brachial valve geniculate with moderately concave visceral disc; trail less concave, at about right angle to visceral disc in two paratypes; ears well delimited by convex flexures; trail evenly concave on dorsum, sloping steeply to lateral margins, forming U-shaped anterior profile as in opposite valve; ornamentation similar to that of pedicle valve but with very weak rugae across visceral disc; fewer and smaller spine bases than on pedicle valve; internal details not observed.

Distinguishing characters.—*Ovatia nascens* n. sp. can be differentiated by its ornament of 25–27 costellae per cm at a surface measurement of 25 mm from the ventral beak, by its thin body cavity, and the very weak rugae on the visceral disc of the brachial valve.

Remarks.—This new species is similar to two other Lower Mississippian species of the genus *Ovatia* Muir-Wood and Cooper. They are *Ovatia laevicosta* (White), from the Wassonville Dolomite of southeastern Iowa, and *Ovatia prolata* Carter, 1987, from the Banff Formation of Alberta. *Ovatia laevicosta* differs from this new Glen Park species in having a less inflated, broader, umbonal region and coarser costellae, about 20–27 per cm measured at a surface measure distance of 25 mm from the ventral beak. *Ovatia prolata* has finer costellae than *Ovatia nascens* n. sp., about 30–40 per cm at a surface measure distance of 25 mm from the ventral beak, has much stronger rugae on the visceral disc of the brachial valve, and has fewer rugae on the sides of the umbonal region.

Weller (1914:pl. 16, fig. 13) figured a specimen of this species from the English River Sandstone at Burlington, Iowa, as *Productus ovatus* Hall, 1858.

Table 18.—*Measurements (in mm) of types of* Ovatia nascens *n. sp. from locality SL392.*

Specimen no.	Length	Width	Height	Surface measure
Holotype (PV)				
CM 34660	33.9	+22.3	16.1	51.9
Paratype (BV)				
CM 34661	25.2	−27.9	15.2	41.4
Paratype (BV)				
CM 34662	23.9	20.4	15.6	37.7

Table 19.—*Measurements (in mm) of the illustrated specimens of* Sedenticellula hamburgensis *(Weller), including the lectotype.*

Specimen no.	Locality	Length	Width	Thickness
Lectotype (brachial valve)				
FMNH UC13937	SL395	10.7	13.3	4.3
Referred specimens				
CM 34671	SL392	12.5	13.9	7.1
CM 34673	SL397	11.3	12.2	6.6
CM 34672	SL392	10.2	10.8	5.8
IGS 80P48	SL392	9.6	11.1	5.7
IGS 80P49	SL392	8.3	8.4	4.2
IGS 80P50	SL392	6.8	6.1	2.6
IGS 80P51	SL392	5.4	5.2	2.4

Although this species marks the lowest occurrence of the genus *Ovatia* in North America, it is probable that the genus occurs in Famennian age beds in the Soviet Union. It has been reported in late Famennian (or Etroeungt) age beds of Kazakhstan by Grechishnikova (1966), Bublichenko (1971) and Litvinovich et al. (1975), from the late Famennian of the southern Urals by Nalivkin (1979), and from Famennian age beds in Timan-Pechora by Fotieva (1985).

Distribution.—This description is based on a collection of 11 specimens from Horton Creek, Pike County, Illinois, SL392. One other pedicle valve was recovered from locality SL393. This species is moderately common in the English River Sandstone in the vicinity of Burlington, Iowa. Although these English River specimens are preserved in a soft coarse sandstone, they agree in all determinable morphological characters with the Glen Park specimens from Pike County, Illinois.

Order Pentamerida Schuchert and Cooper
Suborder Syntrophiidina Ulrich and Cooper
Superfamily Stenoscismatacea Oehlert
Family Atriboniidae Grant
Subfamily Atriboniinae Grant
Genus ***Sedenticellula*** Cooper, 1942

Sedenticellula hamburgensis (Weller, 1910)
Fig. 9.17–9.45, 10

*1910 *Camarophoria hamburgensis* Weller: p. 500–501, fig. 2.
v*1914 *Camarophoria hamburgensis* Weller: Weller, p. 170–172, pl. 23, fig. 52–60; text-fig. 2.
1965*a* *Sedenticellula hamburgensis* (Weller): Grant, p. 73–75, pl. 21, fig. 1–12; text-fig. 14.
1965*b* *Sedenticellula hamburgensis* (Weller): Grant, *in* Williams et al., fig. 511: 1a–c; 512: 1a–o.

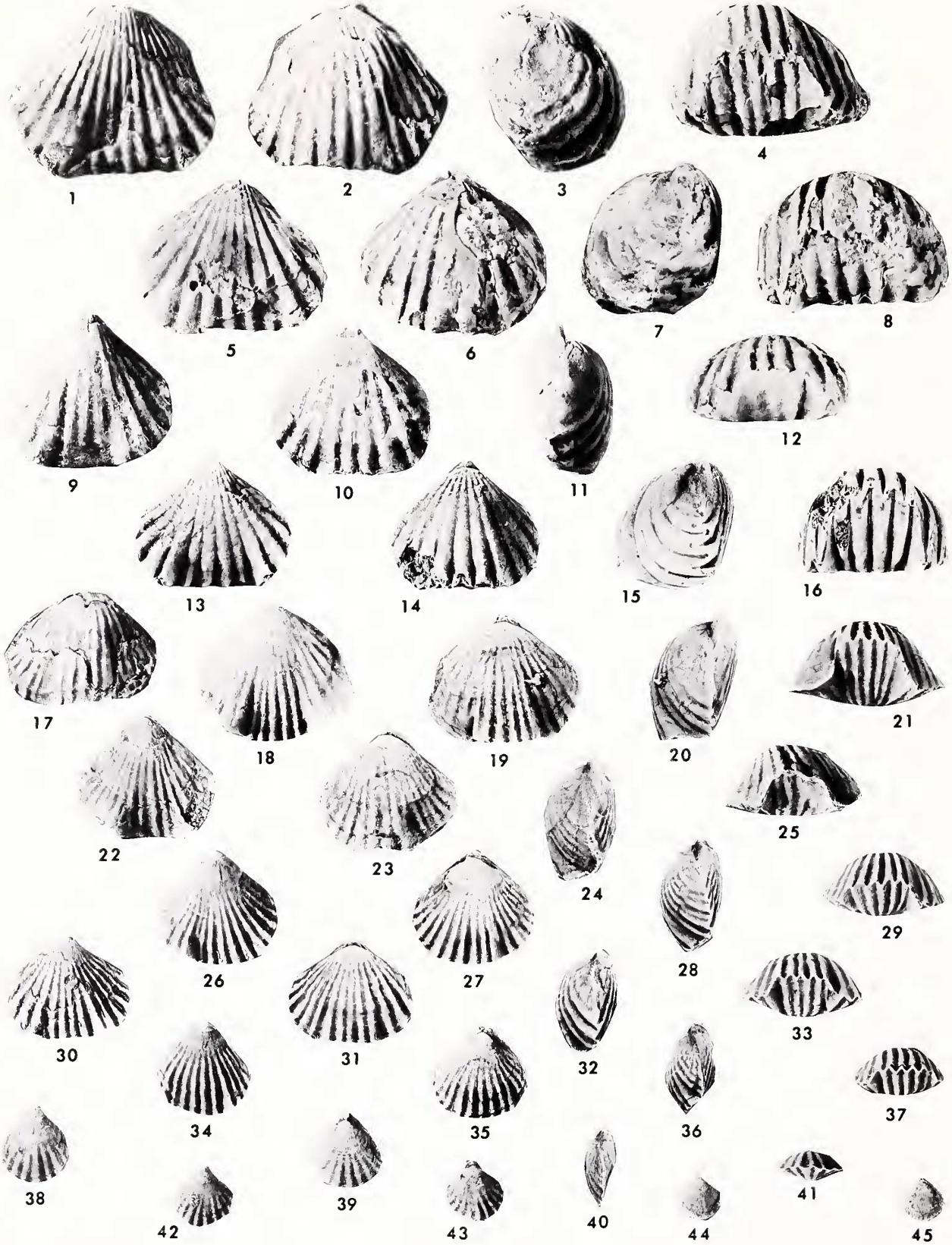
Lectotype.—Designated by Grant, 1965*a*, as FMNH UC13937, illustrated by Weller, 1914, pl. 23, fig. 57; illustrated here as Fig. 9.17.

Diagnosis.—Small for the genus, distinctly rostrate, outline subpentagonal to subtrigonal; ventral beak ridges angular and slightly compressed; brachial valve much more convex than pedicle valve in mature specimens; fold and sulcus well defined and of moderate breadth; ribs simple and subangular; ventral spondylium sessile posteriorly but rising slightly on a short septum anteriorly or with low septum obscured by callus.

Comparisons.—The only other species assigned to this genus is *Sedenticellula sacra* Grant, 1965, of Late Kinderhookian or Early Osagean age, from the Chappel Limestone of central Texas. This younger species differs greatly from the type species in its larger size, broad subelliptical outline, small ventral beak, broad fold and sulcus, and numerous bifurcating costae.

Remarks.—Weller (1910, 1914) mistakenly believed that the spondylium was completely sessile in this species. All specimens sectioned by this writer have clearly shown the presence of a low but distinct septum in the pedicle valve (see Fig. 10, sections 2.7 and 3.2). The septum shows clearly in thin section but is often obscured by shell callus, especially in longitudinal view, except at the anterior termination of the spondylium in mature specimens. Virtually all of the juvenile specimens observed have a distinct septum except near the beak where the spondylium is sessile in all specimens, both juvenile and adult.

Distribution.—This is one of the most common species in the oolitic facies of the Glen Park Formation, occurring in great numbers at localities SL393, SL395 and SL397. A single specimen was found at SL396. Weller (1906) failed to recover this species at Glen Park, Missouri (SL397) but this writ-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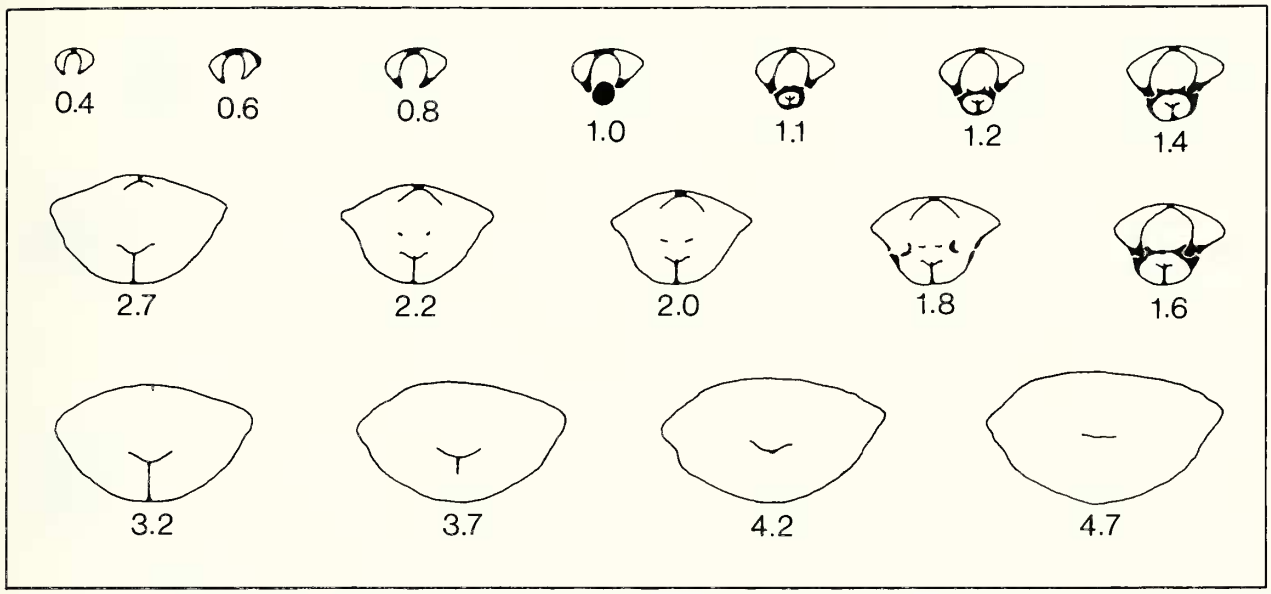

Fig. 10.—Transverse serial sections of *Sedenticellula hamburgensis* (Weller) from SL393, CM 34674. Numbers refer to distance in mm from ventral beak. ×3.

er found it to be one of the most common species there.

Order Rhynchonellida Kuhn
Superfamily Rhynchonellacea Gray
Family Pugnacidae Rzhonsnitskaya
Genus ***Shumardella*** Weller, 1910

Shumardella fracta, new species
Fig. 11.1–11.35, 12

Holotype.—CM 34675, Fig. 11.1–11.5, collected by the author from locality SL392, Horton Creek, Pike County, Illinois.

Paratypes.—CM 34676–34681, Fig. 11.6–11.35, same collection as the holotype.

Description.—Medium size for the genus, unequally biconvex, transversely subtrigonal in outline, greatest width attained anterior to midlength; lateral profile subtrigonal to subovate; anterior commissure strongly uniplicate, slightly serrate; fold and sulcus produced in anterior half of shell becoming broad and shallow near anterior margin with moderately large tongue; lateral margins slightly curved or straight but not serrate; cardinal margins slightly compressed; ribs poorly developed on both fold-sulcus and flanks; sulcus bald or with one to three weak subangular plicae; flanks bald or with one to three weak to moderately well expressed subangular plicae; growth varices irregularly spaced; moderately coarse irregular growth lines present but other microornament, if any, not preserved.

Pedicle valve shallow except for tongue, gently convex posteriorly, sloping more steeply near lateral margins and in sulcus; umbonal region not inflated; beak small, short, slightly incurved, forming beak angle of 90 degrees or more; beak ridges moderately well defined, forming short palintropes on each side of beak; delthyrium obscured by dorsal umbo; deltidial plates not observed; sulcus originating in anterior half of valve, becoming broader but remaining shallow throughout, forming emarginate outline; plicae, if present, originating near margins in all specimens observed; interior with very short slender moderately diverging dental plates; teeth very small; muscle field not impressed.

Brachial valve much more inflated than opposite valve, becoming strongly inflated and tumid medially and sloping steeply to antero-lateral margins; maximum depth attained near anterior margin; umbonal region moderately convex, defined by short shallow concave lateral flexures; beak small, obscured by ventral valve in some specimens; fold not well defined, originating anterior to umbonal region; lateral plicae weaker and more obscure than those of opposite valve; interior with very short, open septalium supported by short low median septum which extends forward into posterior portion of umbonal region; outer hinge plates moderately depressed medially, attached to ventro-medial

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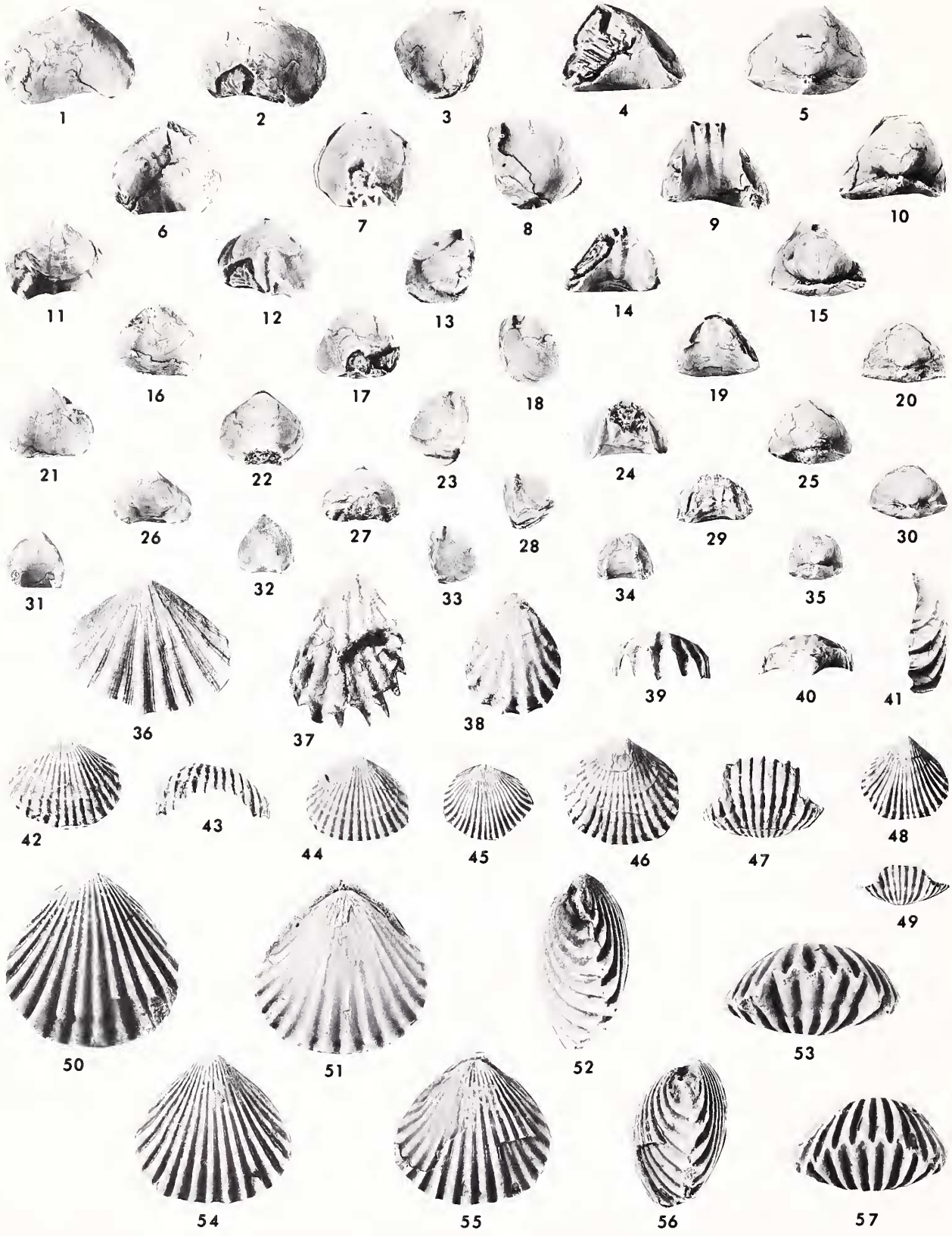
Fig. 9.—Rhynchoporids and pentamerids. 9.1–9.16, *Rhynchopora hamburgensis* Weller; 9.1–9.4, ventral, dorsal, lateral and anterior views of the lectotype, FMNH UC7742, from SL395; 9.5–9.12, ventral, dorsal, lateral and anterior views of two paralectotypes from SL395, FMNH UC7742; 9.13–9.16, ventral, dorsal, lateral and anterior views of a nearly complete specimen from SL392, CM 34670; all ×3. 9.17–9.45, *Sedenticellula hamburgensis* (Weller); 9.17, the lectotype, a brachial valve, FMNH UC13937; 9.18–9.45, ventral, dorsal, lateral and anterior views of seven specimens from SL393 (9.18–9.21, 9.26–9.45) and SL397 (9.22–9.25), CM 34671–34673, IGS 80P48–80P51, respectively; all ×2.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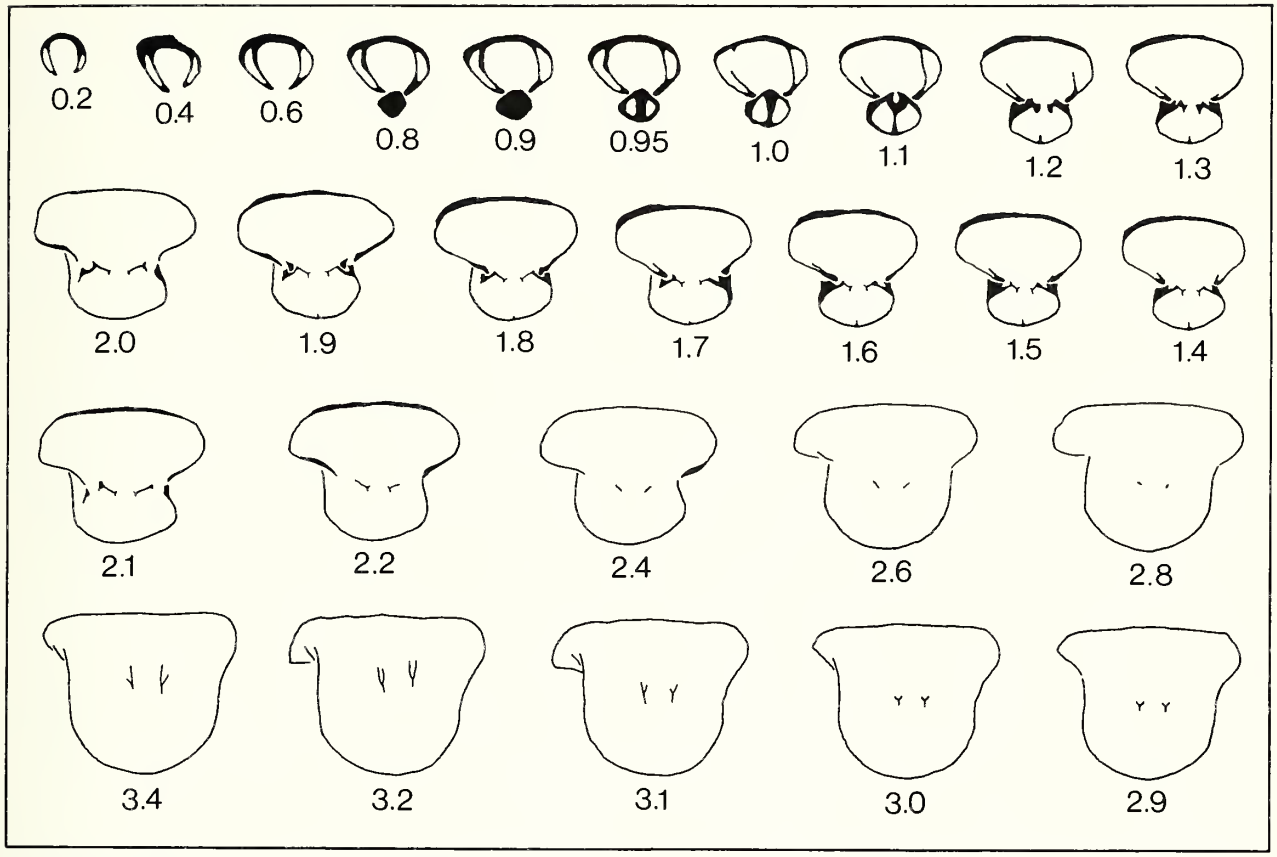

Fig. 12.—Transverse serial sections of *Shumardella fracta* n. sp. from SL392, CM 34686. Numbers refer to distance in mm from ventral beak. ×3.

edges of inner socket ridges; crural bases small, directed slightly laterally, slightly arcuate; crura short to moderate in length, broad and flat posteriorly, becoming very thin before becoming ventrally concave and curving ventrally, forming ventrally concave Y-shaped processes supported by low dorsally directed vertical plates; muscle field not observed in transverse section.

Distinguishing characters.—The weak ribbing on both fold-sulcus and flanks, subtrigonal outline with greatest width anterior to midlength, and broad shallow fold-sulcus serve to distinguish this species from similar related taxa.

Remarks.—This weakly ribbed species is most similar to the common Chouteau Limestone form *Shumardella obsolescens* Weller, 1910. It differs from the latter in its larger size, subtrigonal outline, broader fold-sulcus, and flatter pedicle valve. "*Leiorhynchus*" *greenianum* (Ulrich, 1886), from the Borden Group of Indiana, is another weakly ribbed species commonly assigned to the genus *Shumardella*. It differs from this new Glen Park species in being much larger with an extremely gibbous brachial valve and subovate outline.

Distribution.—This description is based on a single collection of 26 specimens from SL392, Horton

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Fig. 11.—Rhynchonellids. 11.1–11.35, *Shumardella fracta* n. sp.; ventral, dorsal, lateral, anterior and posterior views of a growth series of seven specimens from SL392 including the holotype (11.1–11.5), CM 34675–34681, ×1. 11.36, *Paraphorhynchus* sp., a small pedicle valve from SL393, CM 34682, ×2. 11.37–11.41, *Axiodeaneia glenparkensis* n. sp.; 11.37, a large pedicle valve from SL397, CM 34683; 11.38–11.41, dorsal, anterior, posterior and lateral views of a brachial valve from SL396, the holotype, CM 34684, all ×1. 11.42–11.49, *Rhynchopora prisca* n. sp.; 11.42, 11.43, dorsal and anterior views of a large brachial valve, CM 34685, the holotype, ×1; 11.44, 11.45, two smaller brachial valves, IGS 80P52, 80P53, ×1; 11.46–11.49, ventral and anterior views of two smaller pedicle valves, IGS 80P54, 80P55, ×1.5; all from SL393. 11.50–11.57, *Rhynchopora hamburgensis* Weller, ventral, dorsal, lateral and anterior views of two shells from SL511, IGS 80P56, 80P57, ×3.

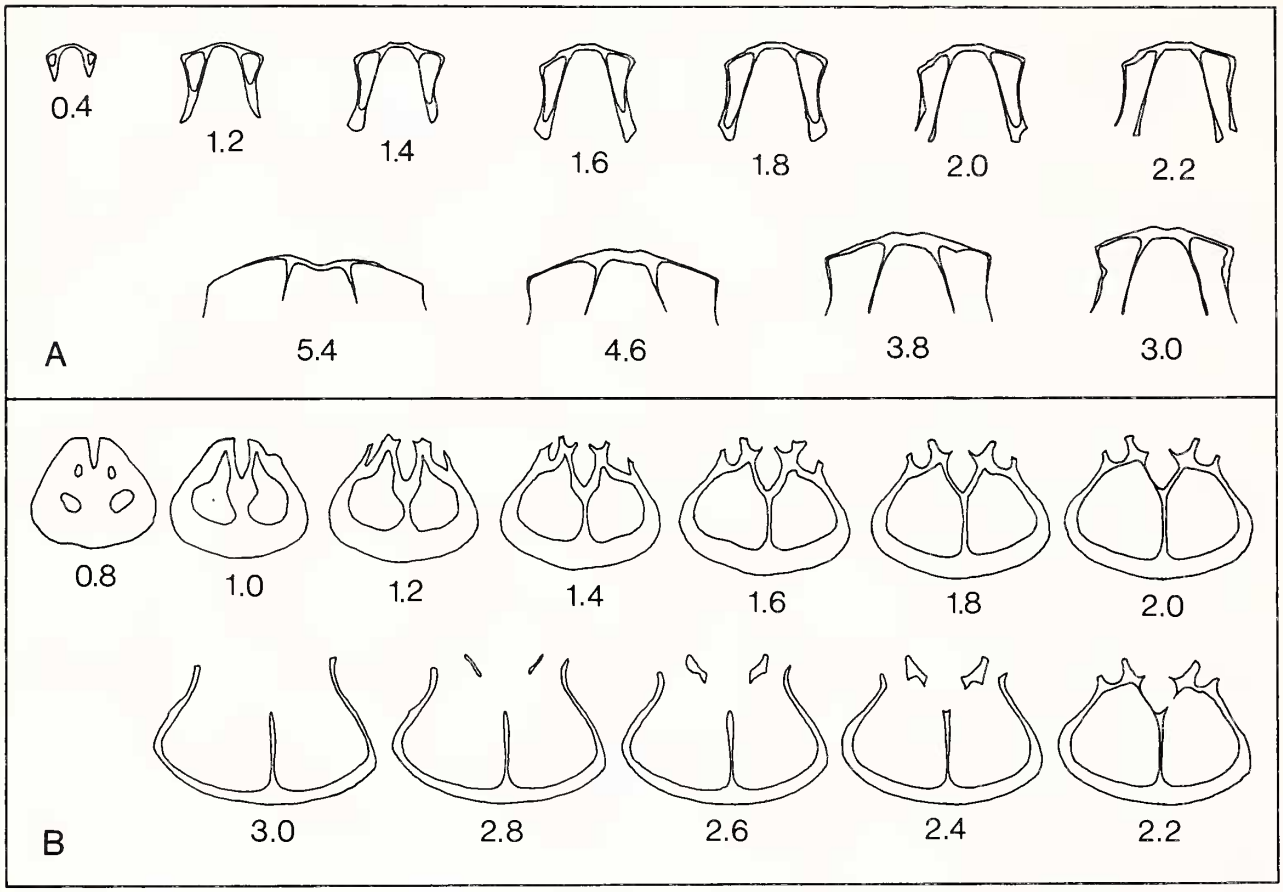


Fig. 13.—Transverse serial sections of *Axiodeaneia glenparkensis* n. sp. from SL396. A, medium sized pedicle valve, CM 34687; B, medium sized brachial valve, CM 34688, both ×3. Numbers refer to distance in mm from beak.

Creek, Pike County, Illinois. One specimen was found at locality SL394.

Family Yunnanellidae Rzhonsnitskaya
Genus ***Paraphorhynchus*** Weller, 1905

Paraphorhynchus sp.
Fig. 11.36

Remarks.—Three pedicle valves of a coarsely ribbed capillate rhynchonellid, all from SL393, are assignable to the genus *Paraphorhynchus* Weller. The best of these specimens, a small pedicle valve, is illustrated here. The other two specimens consist of fragments of a much larger specimen and a moderate sized specimen. The illustrated specimen is undoubtedly a juvenile and lacks the adult characters needed for specific identification.

Table 20.—*Measurements (in mm) of the types of* Shumardella fracta *n. sp. from SL392.*

Specimen no.	Length	Width	Thickness
CM 34675 (Holotype)	+18.6	23.2	±16.2
CM 34676 (Paratype)	19.4	19.7	15.6
CM 34677 (Paratype)	16.6	18.1	12.9
CM 34678 (Paratype)	15.4	+15.5	10.6
CM 34679 (Paratype)	14.0	15.7	10.6
CM 34680 (Paratype)	10.7	14.2	9.3
CM 34681 (Paratype)	11.6	10.5	9.8

Family Rhynchotetradidae Likharev
Genus ***Axiodeaneia*** Clark, 1917

Axiodeaneia glenparkensis, new species
Fig. 11.37–11.41, 13

Holotype.—A medium sized brachial valve, Fig. 11.38–11.41, CM 34684, from locality SL396, collected by the author, November 1985.

Paratypes.—A large pedicle valve, Fig. 11.37, CM 34683, from SL397, collected by the author, April 1986; a large brachial valve, not illustrated, CM 34749, same collection as the preceding; a small pedicle valve, not illustrated, CM 34750, same collection as the holotype.

Description.—Medium size for the genus, subequally biconvex; longitudinally guttate in outline; greatest width attained anterior to midlength, usually in anterior third of shell; anterior profile subquadrate; anterior and lateral margins abruptly truncated and strongly serrate, anterior commissure rectimarginate; fold and sulcus lacking; both valves moderately to weakly convex and sloping evenly to truncated margins; both valves with 9 to 12, usually 11 or 12, medium to strong subangular plicae; moderate growth varices irregularly developed in some specimens; microornament consisting of flattened bifurcating capillae, especially prominent in the interplical furrows, and fine irregularly spaced growth lines.

Pedicle valve somewhat less convex than brachial valve; greatest thickness near midlength; umbonal region narrow, not swollen, subtending an apical angle of less than 90 degrees, usually about 66 to 72 degrees; beak small, acute, almost straight; foramen small, incised, continuous with apex of delthyrium; delthyrium and deltidial plates not observed; beak ridges very sharp, angular, extending forward to midlength, defining long high moderately concave palintropes; two medial plicae originating near beak, other plicae originating by intercalation anterior to beak; outermost lateral plicae sometimes very weakly expressed on ventral surface but producing strong deflections at lateral commissures; interior with strong wide teeth and strong, slightly diverging dental plates that converge slightly to valve floor (see Fig. 13A); muscle field not observed in transverse sections.

Brachial valve moderately thicker than opposite valve, sometimes with strong median plica originating in umbonal region (holotype lacks median plica in umbo); umbo moderately or weakly convex, well delimited by subangular beak ridges that also define large concave palintropes that extend forward to near midvalve; otherwise similar to opposite valve externally; interior with deep open septalium, becoming about as wide as deep anteriorly, supported by strong high median septum that extends forward from one-third to one-half valve length; inner socket ridges high, strong, becoming rounded anteriorly; outer hinge plates narrow, almost obsolete; inner hinge plates absent; crural bases flattened, thick, directed dorso-medially in transverse section posteriorly; distal portions of crura not observed.

Distinguishing characters.—This species can be differentiated by its guttate outline, 11 or 12 plicae per valve, apical angle of about 66 to 72 degrees, and very long concave palintropes on both valves defined by angular beak ridges. Internally, the inner hinge plates are nearly obsolete and the dorsal septum extends forward from one-third to one-half the valve length.

Remarks.—*Axiodeaneia glenparkensis* n. sp. is most similar to the type species of the genus, *Axiodeaneia platypleura* Clark, 1917, from the Lodgepole Limestone of Montana. The latter differs in its fewer ribs, less angular shorter beak ridges, and much smaller palintropes on both valves. *Rhynchotetra elongatum* Weller, 1914, from the Pierson Limestone of southwestern Missouri is very similar to the type species and may be distinguished in the same manner. *Axiodeaneia usheri* (Brown), from the Banff Formation of Alberta, is much larger, thicker, has a subovate outline, and is not easily confused with *Axiodeaneia glenparkensis* n. sp.

Table 21.—*Measurements (in mm) of the types of* Axiodeaneia glenparkensis *n. sp.*

Specimen no.	Locality	Length	Width	Thickness	Rib no.
		Brachial valves			
CM 34684	SL396	22.3	17.5	7.8	11
CM 34749	SL397	25.1	18.9	13.6	12
		Pedicle valves			
CM 34683	SL397	27.0	+22.0	±8.8	9
CM 34750	SL396	20.4	19.3	6.5	12

Distribution.—*Axiodeaneia glenparkensis* n. sp. has been found at only three localities in the Glen Park Formation. The largest collection, from SL 396, consists of 15 specimens, including seven brachial valves, four pedicle valves, and four large fragments. A second smaller collection, from SL397, is comprised of one large pedicle valve, one large brachial valve, and one large fragment. Weller and St. Clair (1928:161) reported the presence of an undescribed *Rhynchotetra* from SL520 that undoubtedly is this species.

Order Uncertain
Superfamily Rhynchoporacea Muir-Wood
Family Rhynchoporidae Muir-Wood
Genus ***Rhynchopora*** King, 1865

Rhynchopora hamburgensis Weller, 1910
Fig. 9.1–9.16, 11.50–11.57, 14

*1910 *Rhynchopora hamburgensis* Weller, p. 515, fig. 17.
v*1914 *Rhynchopora hamburgensis* Weller: Weller, p. 228–230, pl. 29, fig. 19–30, text-fig. 20.

Lectotype.—Designated herein, FMNH UC7742, illustrated here, Fig. 9.1–9.4, illustrated by Weller (1914:pl. 29, fig. 19–22), from locality SL395.

Paralectotypes.—Fifteen in all, FMNH UC7742, including two complete specimens illustrated here, Fig. 9.5–9.12, and illustrated by Weller (1914:pl. 29, fig. 23–30), same collection as the lectotype.

Diagnosis.—Small rhynchoporids, usually wider than long, with subtrigonal to subpentagonal outline, three to six (usually four or five) rounded to subangular costae in the sulcus, and five to eight (usually five to seven) subangular costae on the flanks.

Remarks.—In general, Weller's (1914) description of this species is accurate for the collection of syntypes. The variability in outline, degree of inflation, and number of ribs, especially on the flanks, is worth noting here. Weller described the species

Table 22.—*Measurements (in mm) of the lectotype, two paralectotypes, and three other illustrated specimens of* Rhynchopora hamburgensis *Weller, 1910, from the Glen Park Formation of Missouri and Illinois.*

Specimen no.	Locality	Length	Width	Thickness	Ribs/sulcus	Ribs/flank
Lectotype FMNH						
UC7742	SL395	+10.8	12.2	8.6	5	7
Paralectotype FMNH						
UC7742	SL395	10.2	11.5	8.7	5	5
Paralectotype FMNH						
UC7742	SL395	9.3	9.7	5.8	3	6
Referred specimens						
CM 34670	SL392	8.1	9.0	6.7	4	5
IGS 80P56	SL511	10.4	10.5	5.4	4	7
IGS 80P57	SL511	9.1	9.5	5.7	5	7

Table 23.—*Measurements (in mm) of the types of* Rhynchopora prisca *n. sp. from locality SL393.*

Specimen no.	Length	Width	Thickness	Costae: Flanks	Costae: Fold/sulcus
Brachial valves					
Holotype					
CM34685	16.2	20.6	8.0	8	8
Paratypes					
IGS 80P52	10.3	12.4	3.6	7	8
IGS 80P53	9.0	10.4	2.9	10	7
Pedicle valves					
IGS 80P54	14.0	13.8	7.5	8	6
IGS 80P55	10.5	10.8	4.9	11	6

as having about five ribs on each flank. This is true for many of the syntypes but the specimen chosen here as lectotype has seven costae on the flanks, and one other syntype illustrated here (Fig. 9.9–9.12) has six. Fifty-one percent of the studied specimens from other localities had seven costae on each flank and 86 percent of these specimens had more than five costae on each flank.

Weller's description of the interior is satisfactory except for the following items. The hingeplate or connectivium is perforated posteriorly as in all other species of this genus (see Fig. 14, section 1.0). The connectivium bears a median ridge for muscle attachment posteriorly but becomes ventrally convex anteriorly and extends well forward of the sockets. The crura are typically rhynchoporid, curving ventrally and becoming comma-shaped, arcuate, or troughlike anteriorly.

Rhynchopora hamburgensis Weller is not very similar to other Mississippian rhynchoporids in North America. It is much smaller than most other species and that feature, plus its ribbing pattern, allows easy differentiation from most other taxa. *Rhynchopora pustulosa* (White), from the McCraney Limestone at Burlington, Iowa, is almost as small as *Rhynchopora hamburgensis* Weller but has fewer, coarser costae and a more subovate outline.

Distribution.—This is one of the most abundant and widely distributed species in the Glen Park Formation, being present in countless numbers at several localities. It is common at all of the localities discussed in this report except for localities SL392 and SL394, which share a distinctive low diversity facies controlled fauna of only a few species.

Rhynchopora prisca, new species
Fig. 11.42–11.49

Holotype.—A brachial valve, CM 34685, Fig. 11.42–11.43, from locality SL393, collected by the author in April 1985.

Paratypes.—Two pedicle valves and two brachial valves, IGS 80P52 through 80P55, from locality SL393, Fig. 11.44–11.49, collected by C. Collinson.

Description.—Medium sized to large for genus, transversely subovate to subquadrate in outline, unequally biconvex; greatest width attained near or anterior to midlength; anterior commissure uniplicate and serrate; fold low, broad, flattened anteriorly; sulcus shallow, broad, with flattened or weakly concave floor and strongly deflected tongue; surface multicostate with 7 to 11 simple subangular costae on each flank, usually 8 or 9, and 6 or 7 in the sulcus or 7 or 8 on the fold; growth varices moderately strong, irregularly spaced; shell substance finely punctate.

Pedicle valve moderately to weakly convex posteriorly, sloping steeply near lateral margins, curving normal to lateral commissure anteriorly to form moderately large tongue; umbonal region slightly inflated, moderately narrow in small specimens, becoming broad in adults; beak small, suberect or slightly incurved; weak low beak ridges extending laterally from beak, defining narrow palintropes; interior with short slender divergent dental plates; other internal details not observed.

Brachial valve much more convex than pedicle valve, inflated anteriorly; dorsum weakly concave posteriorly in umbonal region then becoming flattened anteriorly on fold; umbonal region broad, weakly convex, not inflated, defined by shallow concave flexures, compressed laterally and forming narrow flanges; beak small, slightly incurved; fold poorly defined posteriorly, rising slightly anteriorly, remaining low throughout, becoming much broader anteriorly; flanks sloping evenly and steeply to lateral margins in small specimens, vertically truncated in large specimens; interior with long slender median septum extending forward for about one-third valve length; other internal details not observed.

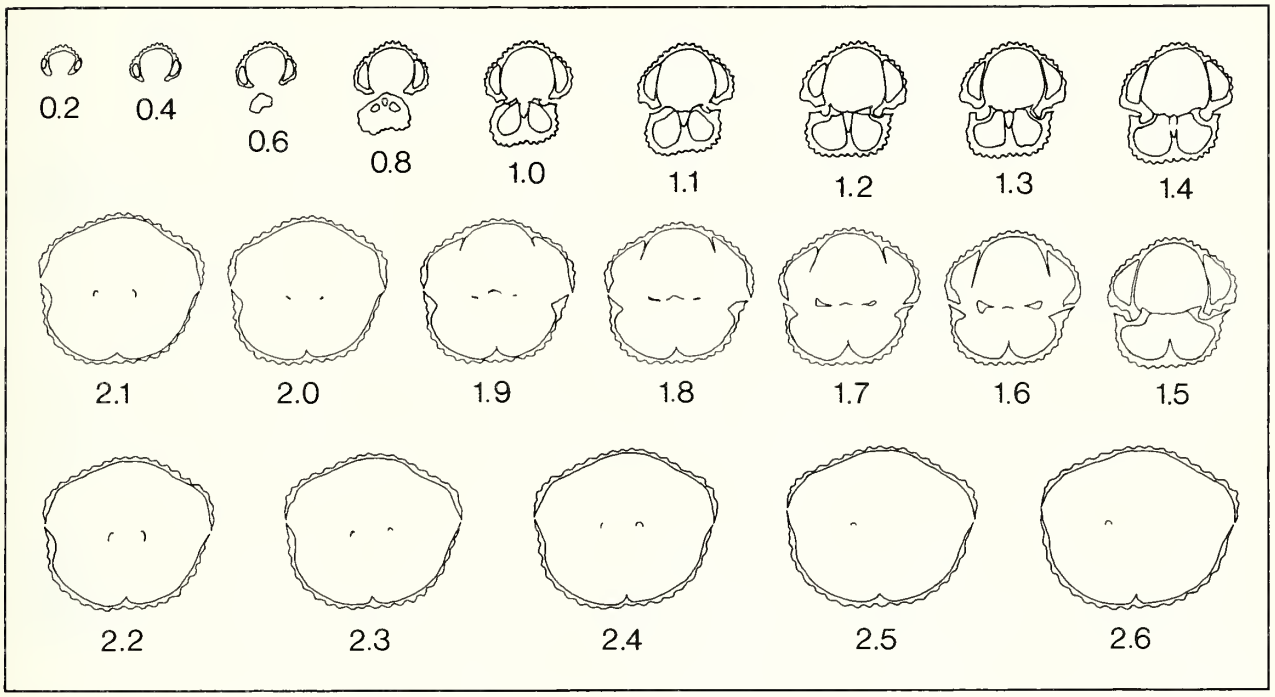


Fig. 14.—Transverse serial sections of *Rhynchopora hamburgensis* Weller from SL511, IGS 80P58. Numbers refer to distance in mm from ventral beak. ×4.

Distinguishing characters.—This species is characterized by its large size and broadly subovate to subquadrate outline, seven to 11, usually eight or nine, coarse subangular costae on each flank, and six or seven costae in the sulcus or seven or eight on the fold; the fold and sulcus are flattened and the dorsum bears a shallow concave sulcus posteriorly.

Remarks.—Its greater size and more numerous costae serve to distinguish this species from the smaller subtrigonal *Rhynchopora hamburgensis* Weller with which it occurs. Small specimens of *Rhynchopora prisca* n. sp. are similar in outline to large specimens of *Rhynchopora hamburgensis* Weller but have more costae on the flanks. *Rhynchopora prisca* n. sp. is not closely similar to other previously described Mississippian rhynchoporids in North America. Some smaller specimens bear general similarity in outline to *Rhynchonella cooperensis* Shumard, 1855, from the Chouteau Limestone of Missouri but the latter, according to Weller (1914:237), has fewer costae and may not be punctate.

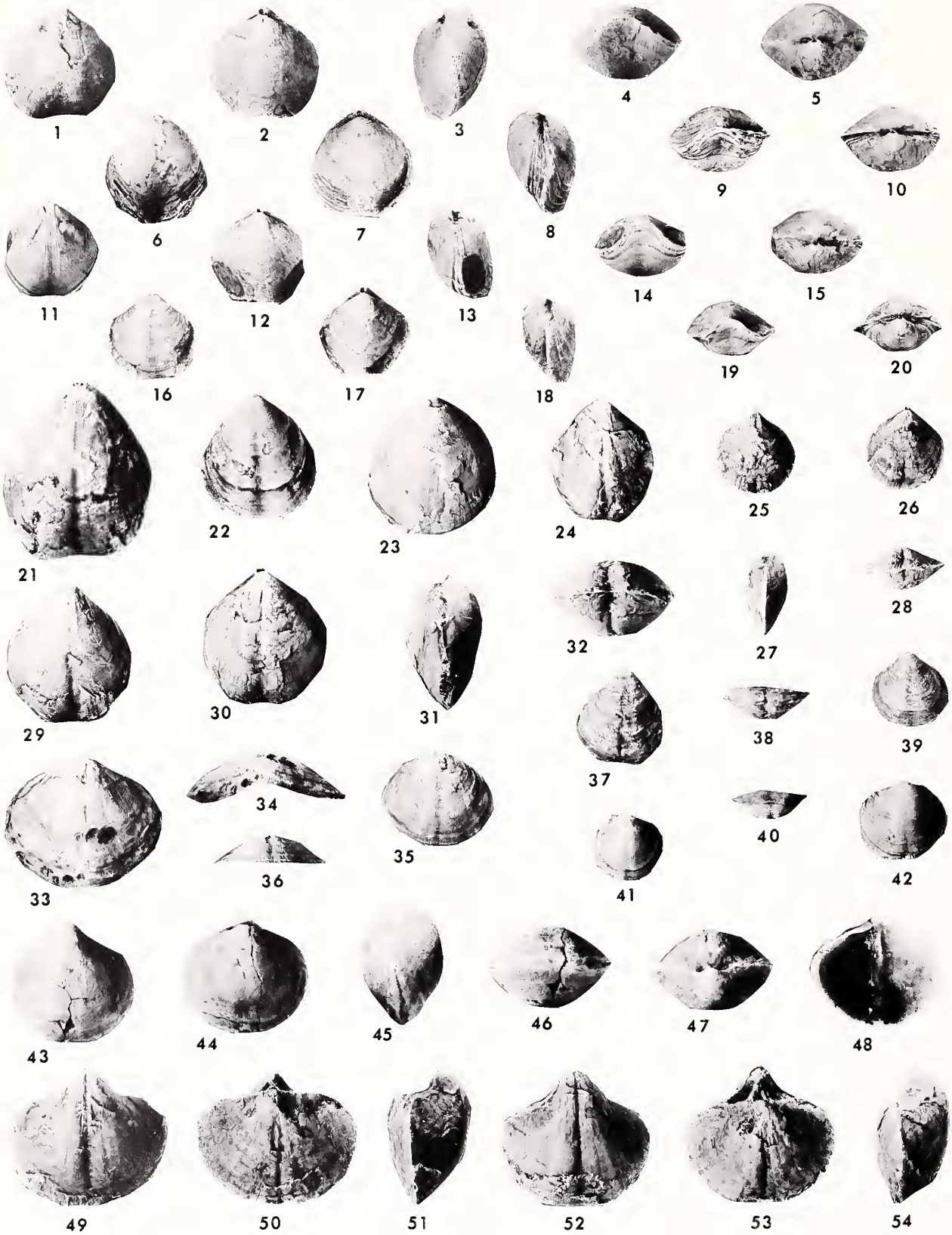
Distribution.—This description is based on a single collection of nine specimens from locality SL393. All of the specimens are disarticulated, there being five brachial and four pedicle valves.

Order Athyridida Boucot, Johnson and Staton
Suborder Athyrididina Boucot, Johnson and Staton
Superfamily Athyridacea Davidson
Family Meristidae Hall and Clarke
Subfamily Camarophorellinae Schuchert
Genus ***Camarophorella*** Hall and Clarke, 1893

Camarophorella cf. ***C. buckleyi*** (Rowley, 1908)
Fig. 15.32–15.39

1865 *Spirigera missouriensis* Winchell, p. 117 (not Swallow, 1860).
v*1908 *Seminula buckleyi* Rowley, p. 79, pl. 17, fig. 48–53.
v.1914 *Camarophorella missouriensis* (Winchell): Weller, p. 460–462, pl. 82, fig. 70–79.
v.1943 *Camarophorella buckleyi* (Rowley): Williams, p. 91, pl. 7, fig. 21, 22.
1967 *Camarophorella* cf. *C. buckleyi* (Rowley): Rodriguez and Gutschick, p. 379, pl. 44, fig. 21–24, 37, 38.

Remarks.—A small collection of eight specimens belonging to the genus *Camarophorella* Hall and Clarke was recovered from locality SL393. Several of these specimens have spalled translucent layers of shell material that show the internal structures, as well as the characteristic finely papillose inner surface of the valves which simulates punctation. The two largest specimens are brachial valves as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large as, or slightly larger than, large specimens of authentic *Camarophorella buckleyi* from the Louisiana Limestone. The two pedicle valves illustrated here (Fig. 15.37–15.40) are much smaller than the brachial valves and probably represent juveniles. Their outline is similar to comparably sized growth lines of *C. buckleyi* pedicle valves. In outline, proportions, development of a shallow ventral sulcus, and presence of a shallow narrow medial sinus on both valves, these specimens are similar in most respects to *C. buckleyi* (Rowley). However, certain identification of at least some species of the genus *Camarophorella* requires internal details. The writer was reluctant to destroy any of the few specimens at hand in order to make this determination. Therefore, the specimens are compared with the Louisiana Limestone species, but identification is not certain.

Family Spirigerellidae Grunt
Genus ***Composita*** Brown, 1849

Composita matutina, new species
Fig. 15.1–15.20, 16

Holotype.—Fig. 15.1–15.5, CM 34689, collected by the author from locality SL393, April 1985.

Paratypes.—Fig. 15.6–15.20, CM 34690–34692, collected by the author from locality SL392, April 1983.

Description.—Medium size for genus, subequally biconvex, slightly elongate, subpentagonal to longitudinally subovate in outline; lateral profile guttate to sublenticular; maximum width attained near midlength; fold and sulcus weakly to moderately developed, anterior commissure uniplicate; ornament simple, consisting only of irregularly spaced growth varices and faint growth lines.

Pedicle valve slightly thicker than brachial valve, most convex in umbonal region, curving evenly to lateral margins; beak small, broad, incurved, subtending an angle of from 97 to 107 degrees; foramen small, rounded, abutting dorsal umbo; delthyrium closed by dorsal valve; venter slightly arched in umbonal region, with shallow rounded sulcus in anterior two-thirds of shell; cardinal extremities moderately broad, rounded, slightly compressed; lateral slopes weakly convex, curving evenly to lateral margins; interior with slender divergent dental plates and wide bladelike teeth; muscle field weakly impressed, longitudinally striated.

Brachial valve most convex in umbonal region, medially arched; flanks weakly convex, sloping evenly to lateral margins; fold very low, poorly delineated only in anterior third or half of valve; cardinal extremities slightly compressed; dorsal umbo slightly tumid; beak small, obscured by delthyrium; interior with broad deep sockets enclosed by very high thin ventro-laterally diverging inner socket ridges that enclose medial edges of teeth; apically perforate transverse hingeplate attached to inner surfaces of inner socket ridges, extending well forward of sockets; crural bases attached to dorsal edges of inner socket ridges and lateral edges of hingeplate; brachidial details and dorsal muscle field not observed.

Distinguishing characters.—This species is characterized by its subpentagonal outline, weakly to moderately developed fold and sulcus, broad ventral umbonal region and beak which subtends an angle of 97 to 107 degrees, and moderately arched dorsum.

Remarks.—*Composita matutina* n. sp. is most similar to the Famennian species, *Composita bellula* Stainbrook, 1947, from the Box Member of the Percha Formation of New Mexico. The latter differs in being larger and less inflated; it is more transverse, and the fold and sulcus are stronger, originating more posteriorly than in *Composita matutina* n. sp. According to Cooper and Dutro (1982:93) *Composita bellula* is the earliest species of the genus *Composita* Brown.

The only other smooth shelled spirigerellid in North American rocks of this age is *Iniathyris corpulenta* (Winchell) from the English River Sandstone of southeastern Iowa. This species is in no way similar to any species of the genus *Composita* because the foramen is presumably lost in adult shells, or at least none has been detected.

←

Fig. 15.—Athyridids and spiriferids. 15.1–15.20, *Composita matutina* n. sp.; 15.1–15.5, ventral, dorsal, lateral, anterior and posterior views of the holotype from SL393, CM 34689; 15.6–15.20, ventral, dorsal, lateral, anterior and posterior views of three paratypes from SL392, CM 34690–34692, all ×1. 15.21–15.32, *Cardiothyris pristina* n. sp.; 15.21, 15.22, two pedicle valves, CM 34693, 34694; 15.23, 15.24, two brachial valves, CM 34695, 34696; 15.25–15.28, ventral, dorsal, lateral and anterior views of a small complete shell, CM 34697; 15.29–15.32, ventral, dorsal, lateral and anterior views of the holotype, CM 34698; all from SL397; all ×2. 15.33–15.40, *Camarophorella* cf. *C. buckleyi* (Rowley); 15.33–15.36, dorsal and anterior views of two brachial valves, IGS 80P59, 80P60; 15.37–15.40, ventral and anterior views of two small pedicle valves, IGS 80P61, 80P62; all from SL393; all ×1.5. 15.41–15.48, *Nucleospira minima* Weller; 15.41, a small brachial valve from SL397, Weller Collection, paralectotype FMNH UC11349; 15.42, a medium brachial valve from SL397, Weller Collection, the lectotype, FMNH UC11349; 15.43–15.47, ventral, dorsal, lateral, anterior and posterior views of a large complete specimen from SL395, CM 34699; 15.48, interior view of a large pedicle valve from SL395, CM 34700; all ×3. 15.49–15.54, *Crurithyris* cf. *C. levicula* (Rowley), ventral, dorsal and lateral views of two spalled but otherwise complete specimens from SL392, CM 34701, 34702, ×4.

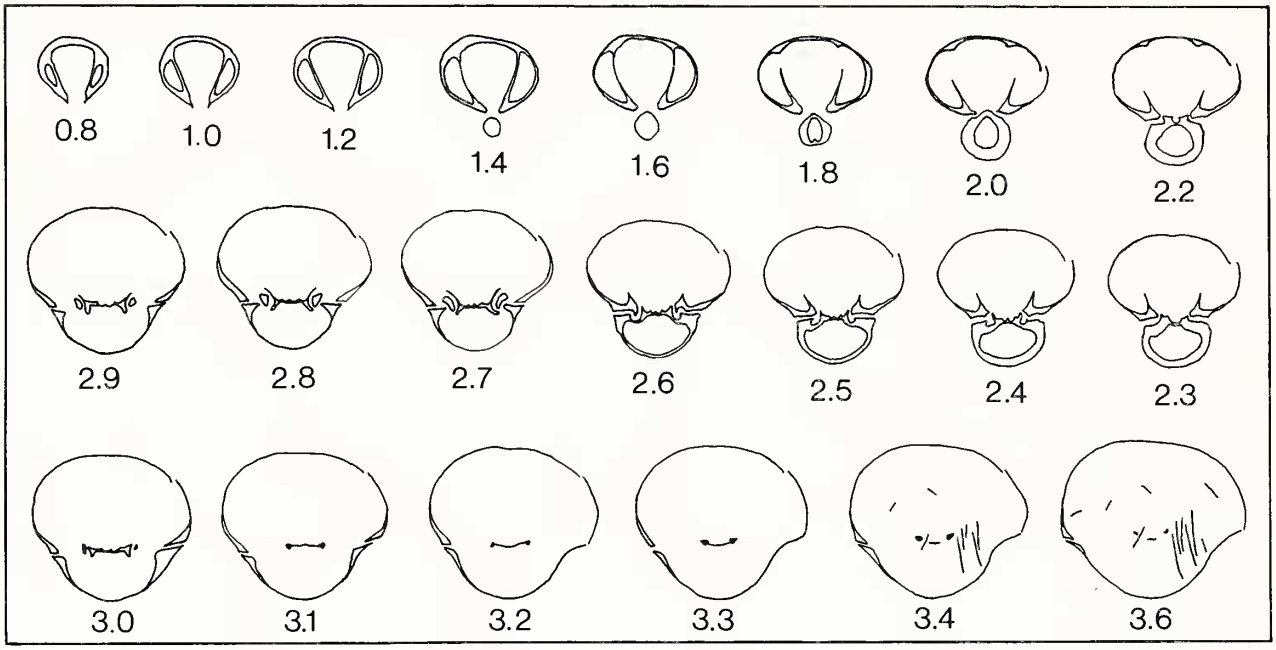


Fig. 16.—Transverse serial sections of *Composita matutina* n. sp. from SL392, CM 34703. Numbers refer to distance in mm from ventral beak. ×2.

Distribution.—*Composita matutina* n. sp. has been found at only two localities in the Glen Park Formation. The holotype and three other disarticulated pedicle valves were found at Brown Branch, Pike County, Illinois, SL393. Ten other specimens, including the three paratypes, are from Horton Creek, Pike County, Illinois, SL392.

Table 24.—*Measurements (in mm) of the types of* Composita matutina *n. sp. from the Glen Park Formation of Illinois.*

Specimen no.	Locality	Length	Width	Thickness
CM 34689	SL393	20.7	20.2	14.3
CM 34690	SL392	19.7	18.5	12.6
CM 34691	SL392	18.1	+17.2	12.1
CM 34692	SL392	16.4	16.3	10.0

Genus ***Cardiothyris*** Roberts, 1971

Cardiothyris pristina, new species
Fig. 15.21–15.32, 17

Holotype.—Fig. 15.29–15.32, CM 34698, collected by the author from locality SL397, April 1986.

Paratypes.—Two pedicle valves, two brachial valves, and one small complete shell, Fig. 15.21–15.28, CM 34693–34697, respectively, same collection as the holotype.

Description.—Medium size for genus, almost equally biconvex, outline longitudinally subovate to guttate; greatest width attained near midlength; lateral profile sublenticular to subguttate; anterior commissure rectimarginate; fold lacking but weak sulcus developed in each valve producing slightly emarginate anterior margin; cardinal margins almost straight or weakly convex or concave; antero-lateral margins rounded; ornament simple, consisting of irregularly spaced growth varices.

Pedicle valve moderately inflated, most convex in umbonal region; maximum thickness attained slightly posterior to midlength; umbonal region of moderate breadth, beak small, short, subtending an apical angle of from 87 to 95 degrees; foramen small, abutting brachial valve; cardinal margins rounded or very slightly compressed in some specimens; flanks evenly convex; delthyrium occluded by dorsal umbo; sulcus originating in umbonal region as faint medial groove, becoming slightly wider and deeper anteriorly but never becoming well developed; interior with slender, short, moderately divergent dental plates and small broad teeth; other internal details not observed.

Brachial valve closely similar to pedicle valve in outline, profile and proportions; slightly shorter than opposite valve, beak obscured by ventral valve; dorsal sulcus usually slightly weaker than that of opposite valve, sometimes absent or evidenced only by narrow flattened anterior portion of dorsum; interior with apically perforate, broad, flattened hingeplate which is thickly fused to low inner socket ridges; sockets deep and wide; crura and brachidial details not observed.

Distinguishing characters.—This species can be differentiated by its small size, longitudinally subovate to guttate outline, rectimarginate anterior commissure, and a narrow shallow sulcus in each valve.

Remarks.—Bisulcate spirigerellids are rare in the Mississippian of North America. *Composita laevis*

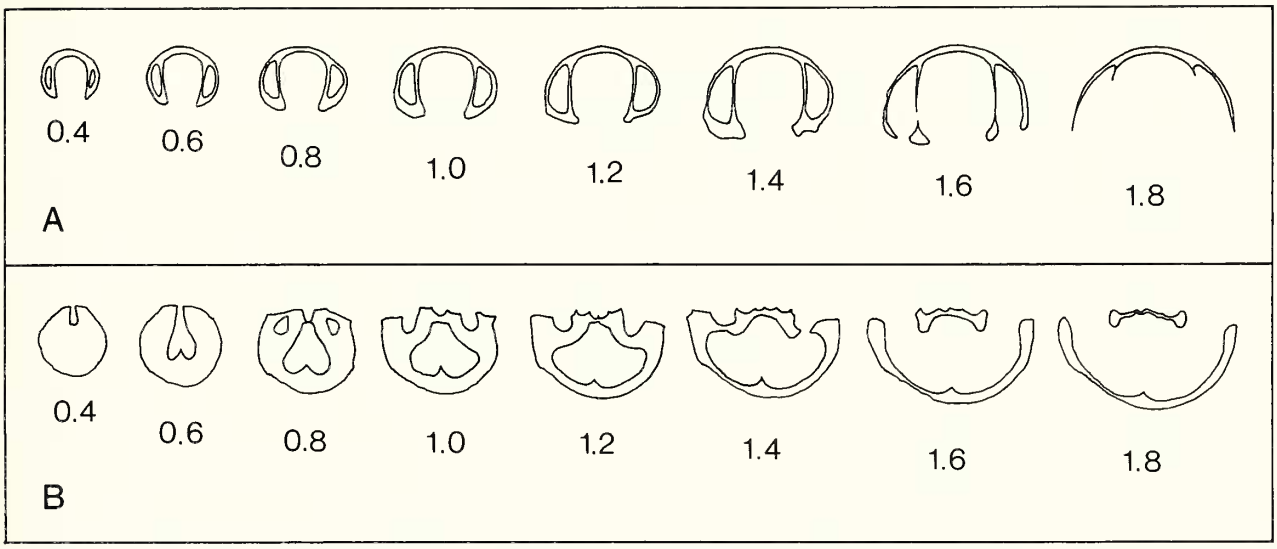


Fig. 17.—Transverse serial sections of *Cardiothyris pristina* n. sp. from SL397. A, medium sized pedicle valve, CM 34704. B, medium sized brachial valve, CM 34705, both ×4. Numbers refer to distance in mm from beak.

Weller, 1914, from Chesterian strata in Kentucky appears to belong in this genus. It is similar in size and the development of a sulcus in each valve but differs from *Cardiothyris pristina* n. sp. in having a more chordate outline with the maximum width being attained well anterior to midlength. A very rare similar species, *Composita lewisensis* Weller, 1914, is said by Branson (1938*a*:76) to be from the Chouteau Limestone of Missouri. It is comparable in size and outline to *Cardiothyris pristina* n. sp. but the ventral sulcus appears to be weaker and a dorsal sulcus, if present at all, is scarcely detectable, resulting in a non-emarginate outline.

Distribution.—*Cardiothyris pristina* n. sp. is found in abundance at locality SL397, Glen Park Quarry, Jefferson County, Missouri. A small collection of 11 speeimens was collected at locality SL396, near Hardin, Calhoun County, Illinois.

Table 25.—*Measurements (in mm) of the types of* Cardiothyris pristina *n. sp. from locality SL397.*

Specimen no.	Length	Width	Thickness
CM 34698	12.3	11.3	7.0
CM 34697	7.5	7.2	3.8
	Pedicle valves		
CM 34693	15.7	13.5	4.6
CM 34694	11.4	10.5	3.4
	Brachial valves		
CM 34695	12.6	11.7	3.6
CM 34696	11.0	9.6	2.5

Superfamily Nucleospiracea Davidson
Family Nucleospiridae Davidson
Genus *Nucleospira* Hall, 1859

Nucleospira minima Weller, 1906
Fig. 15.41–15.48

v*1906 *Nucleospira minima* Weller, p. 447, pl. 6, fig. 29–30.
1914 *Nucleospira minima* Weller: Weller, p. 456–457, pl. 82, fig. 49–60.
1938*a* *Nucleospira minima* Weller: Branson, p. 138–139, pl. 16, fig. 32, 33.

Lectotype.—Designated herein, Fig. 15.42, a brachial valve, FMNH UC11349; also illustrated by Weller (1906:pl. 6, fig. 29; 1914, pl. 82, fig. 50, 56), from locality SL397.

Paralectotypes.—Five brachial valves, FMNH UC11349. The best of these is illustrated here, Fig. 15.40–15.41, same collection as above.

Emended description.—Small for the genus, strongly and subequally biconvex, slightly to moderately wider than long, outline subcircular, lateral profile thickly lenticular to guttate; anterior profile evenly lenticular; narrow shallow median sulcus very poorly developed on both valves, sometimes almost obsolete, producing slightly truncated anterior margin, but not emarginate; anterior commissure rectimarginate; strong irregularly spaced growth varices present but no other ornamentation observed.

Pedicle valve moderately longer and thicker than brachial valve with beak and ventral umbo extending moderately posterior to hingeline; greatest convexity in umbonal region, flanks sloping evenly to lateral and anterior margins; cardinal margins slightly compressed; beak moderately broad and long, suberect; beak ridges angular, short, defining narrow concave interareas; delthyrium small, forming equilateral triangle, with small subdel-

Table 26.—*Measurements (in mm) of* Nucleospira minima *Weller, 1906, from the Glen Park Formation of Missouri and Illinois.*

Specimen no.	Locality	Length	Width	Thickness
Brachial valves				
Lectotype				
FMNH UC11349	SL397	4.6	5.3	2.0
Illustrated paralectotype				
FMNH UC11349	SL397	4.2	4.6	1.9
Other paralectotypes				
FMNH UC11349	SL397	5.3	6.3	2.5
FMNH UC11349	SL397	4.4	4.9	2.2
FMNH UC11349	SL397	4.2	4.4	1.6
FMNH UC11349	SL397	+4.2	+4.3	1.6
Complete referred specimen				
CM 34699	SL395	7.2	7.4	4.9
Referred pedicle valve				
CM 34700	SL395	6.7	8.1	2.7

thyrial plate at apex; deltidial plates not observed; development of sulcus variable, when present, sulcus originating in umbonal region as narrow shallow depression or groove, becoming broader but remaining shallow throughout; in some specimens no discernible sulcus is produced, only a medial flattening being present; interior with long low median ridge extending forward from subdelthyrial plate to about midlength.

Brachial valve substantially shorter and slightly thinner than opposite valve with transversely subovate outline; maximum thickness attained posterior to midlength of valve; umbonal region slightly swollen; beak small and inconspicuous; cardinal margins slightly compressed; flanks sloping evenly to anterolateral margins; development of sulcus similar to that of pedicle valve; interior with long median ridge that extends forward almost to anterior margin; other internal details unknown.

Distinguishing characters.—This species is characterized by its subcircular outline, inflated almost evenly biconvex lateral profile, moderately broad elongate ventral beak, and very weak sulci in both valves.

Remarks.—The lectotype chosen here appears to be a brachial valve, as do all of the specimens in the type suite. Weller (1906, 1914) obviously described some of them as pedicle valves, unless specimens have been lost from the type collection. The description above is based on both the type suite of small brachial valves and the larger specimens from locality SL395, one of which is complete, the other being a large pedicle valve showing interior details. The latter two show the pedicle valve to be quite different in proportions and shape from Weller's description and for this reason an emended description is proposed.

Nucleospira minima Weller is most similar in outline and profile to *Nucleospira hammondi* Branson, 1938, from the Northview Shale of southwestern Missouri. The latter differs in being larger, slightly more elongate, with a stronger ventral sulcus. *Nucleospira obesa* Rowley, 1900, from the lower Burlington Limestone of Pike County, Missouri, also has a subcircular outline and very weak sulci in both valves. It differs from *Nucleospira minima* Weller in having a narrower, shorter ventral beak and less gibbous umbones.

Distribution.—This rare species has been found at only three localities in the Glen Park Formation. The type suite of six brachial valves was collected by Weller from locality SL397. The author has collected only three additional specimens from the same locality. Two specimens were found at locality SL396 and three specimens at locality SL395.

Order Spiriferida Waagen
Suborder Spiriferidina Waagen
Superfamily Cyrtiacea Frederiks
Family Ambocoeliidae George
Genus ***Crurithyris*** George, 1931

Crurithyris cf. ***C. levicula*** (Rowley, 1900)
Fig. 15.49–15.54

v*1900 *Ambocoelia levicula* Rowley, p. 262–263, pl. 5, fig. 12–14.

Diagnosis.—Small transverse unequally biconvex crurithyrids with a narrow ventral umbo posteriorly extended and weak but distinct medial sulci in both valves.

Remarks.—These Glen Park specimens are similar in shape and size to Rowley's syntypes and differ only in minor details. The Glen Park specimens illustrated here are both spalled, lacking the surficial shell layers. The sulci in the brachial valves illustrated here are slightly better defined than those in some *C. levicula* from the Burlington Limestone but this may be due to preservation. Specimens from both formations go through similar ontogenetic allometric growth changes to achieve their final transverse outlines. Juvenile specimens from both formations are narrow and difficult to distinguish from adult specimens of *Ambocoelia minuta* White, from the Louisiana Limestone. Although Rowley (1900) and Weller (1914) did not detect micro-ornament, well preserved specimens from both formations possess the finely spinose micro-ornament characteristic of the genus.

Distribution.—*Crurithyris* cf. *C. levicula* (Rowley) has been found at only two Glen Park Formation localities. The illustrated specimens were taken from a collection of 25 specimens from locality SL392. A small collection of four specimens was obtained from locality SL394.

Genus ***Eudoxina*** Frederiks, 1929

Type species.—*Spirifer medius* Lebedev, 1912.

Diagnosis.—Medium to large unequally biconvex ambocoelliids with pedicle valve much thicker than brachial valve and rounded outline. Rounded fold and sulcus present but weakly developed and poorly differentiated from flanks in most species. Surface of both valves finely costate or costellate, ribs bifurcating freely. Inner shells layers finely pitted, at least in some species. Micro-ornament seemingly lacking. Pedicle valve interior with distinct dental flanges (delthyrial ridges of other authors), lacking dental adminicula. Ventral muscle field deeply impressed. Brachial valve interior with concave finely striate or fimbriate cardinal process, at least in some species, and high antero-laterally directed inner socket ridges (crural plates of other authors). Crural bases attached to dorsal edges of inner socket ridges (Fig. 19). Weak median ridge and long narrow adductor ridges present in some species. Brachidial details unknown.

Stratigraphic range.—This genus appears to be restricted to beds of early Tournaisian age in both the Soviet Union and the North American midcontinent.

Remarks.—The preceding diagnosis is based both on descriptions of the type species from the Soviet Union and the Glen Park species described below. The brachial valve interior was unknown for many years. In recent years Soviet authors such as Poletaev (1971, 1975), Kalashnikov (1974), and Fotieva (1985) have consistently referred to "crural plates" in the brachial valve of *Eudoxina media* (Lebedev). Transverse serial sections of a brachial valve of the Glen Park species clearly show that thin narrow crural bases are attached to the dorsal edges of very high inner socket ridges, not extending to the floor of the valve except apically. The finely striate concave cardinal process in the North American species is very small and has not been reported in Russian specimens. If the striate cardinal process does prove to be present in the type species and is thus a generic character, it may be necessary to reassign *Eudoxina* to a different family.

Eudoxina subrotunda (Weller, 1914)
Fig. 18.1–18.18, 19

v*1858 *Spirifer subrotundatus* Hall, p. 521, pl. 7, fig. 8. (*non* M'Coy, 1855).
1900 *Spirifer subrotundatus* Hall: Weller, p. 76, pl. 2, fig. 8–10.
1914 *Spirifer subrotundus* Weller, p. 356–357, pl. 50, fig. 15–22.

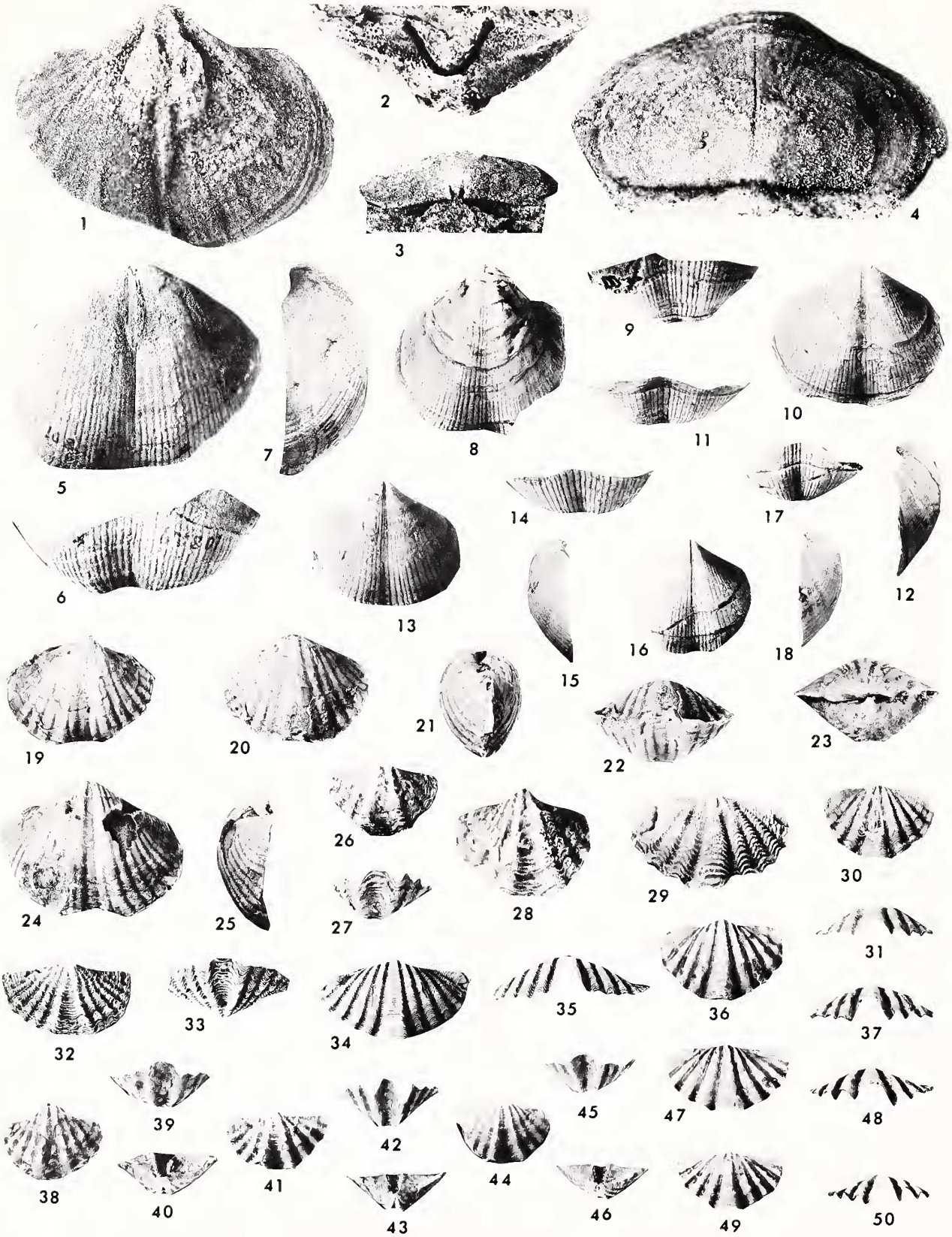
Lectotype.—Designated herein, a very large pedicle valve, UI X-94, Fig. 18.5–18.7, from the English River Sandstone at Burlington, Iowa, collected by A. H. Worthen.

Paralectotype.—A large brachial valve, same locality as above, present location and collector unknown, figured by Hall (1858:pl. 7, fig. 8a).

Diagnosis.—Medium sized *Eudoxina* with broad sloping umbones and shoulders and moderately developed fold and sulcus. Flanks with 25 or more fine flattened costae, many of which bifurcate. Sulcus with ten or more costae similar to those on flanks. Brachial valve interior with deeply concave very finely striate cardinal process, high antero-laterally directed inner socket ridges, and rarely, with very short tabellae.

Remarks.—The satisfactory descriptions of Hall (1858) and Weller (1900, 1914) of the exterior of this well known species were based exclusively on combined internal mold or external cast specimens. That is, external features were impressed upon steinkerns. Information concerning the interior of either valve was not provided by these authors, although many of these sandstone specimens show internal morphology fairly well, especially in both umbones. The four pedicle valves from the Glen Park illustrated here all are composed of original shelly matter but provide no new information concerning the external configuration of this species, including the lack of micro-ornamentation, although one brachial valve shows some indication of fine pitting on a spalled portion of the shell. Internally, Fig. 18.1–18.4 show the lack of dental adminicula, and a deeply impressed ventral muscle field with well differentiated adductor and diductor scars. In the brachial valve very short stout tabellae can be seen supporting the cardinalia, but this character is highly variable in occurrence and probably has little taxonomic significance. The finely striate concave cardinal process and very high inner socket ridges with attached crural bases can be seen in Fig. 19.

Comparisons.—Weller described another species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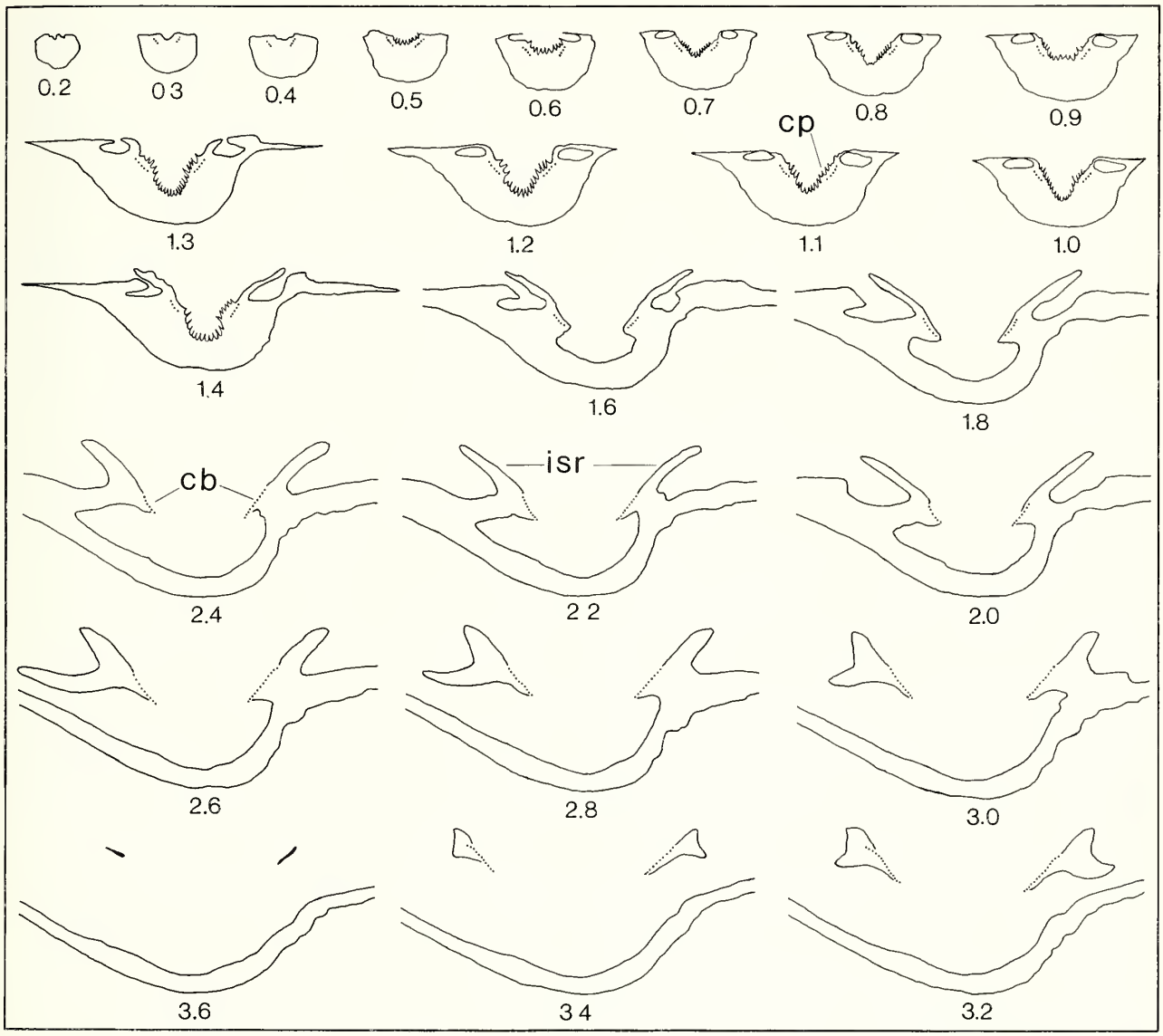

Fig. 19.—Transverse serial sections of a brachial valve of *Eudoxina subrotunda* (weller) from SL393, CM 34755, ×4. (cp = cardinal process, cb = crural base, isr = inner socket ridge.) Numbers refer to distance in mm from dorsal beak.

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Fig. 18.—Spiriferids. 18.1–18.18, *Eudoxina subrotunda* (Weller); 18.1, 18.2, ventral and posterior views of a sandstone mold of the interior of a pedicle valve from the English River Sandstone at Burlington, Iowa, CM 34706, ×2; 18.3, 18.4, sandstone molds of two brachial valve interiors showing tabellae, from the English River Sandstone at Burlington, Iowa, CM 34707, 34708, ×2; 18.5–18.7, ventral, anterior and lateral views of the lectotype, a very large pedicle valve, UI X-94, Worthen Collection, from the English River Sandstone at Burlington, Iowa, ×1; 18.8–18.18, ventral, anterior and lateral (except no lateral for 18.8) views of four pedicle valves from SL393, IGS 80P63, 80P64, CM 34709, IGS 80P65, respectively, all ×1. 18.19–18.25, *Brachythyris hortonensis* n. sp.; 18.19–18.23, ventral, dorsal, lateral, anterior and posterior views of a small paratype, CM 34710; 18.24, 18.25, ventral and lateral views of the holotype, a large pedicle valve, CM 34711, both from SL392, both ×1. 18.26–18.50, *Tylothyris missouriensis* (Weller); 18.26–18.28, two pedicle valves, paralectotypes, FMNH UC11351, from SL397; 18.29–18.31, two brachial valves from SL397, a paralectotype and the lectotype (18.30–18.31); 18.32–18.35, a large pedicle valve and a large brachial valve from SL395, CM 34712, 34713; 18.36, 18.37, 18.47–18.50, dorsal and anterior views of three brachial valves from SL393, IGS 80P66–80P68; 18.38–18.46, ventral, anterior and posterior views of three pedicle valves from SL393, IGS 80P69–80P71; all ×1.5 except 18.28 and 18.29, ×3.

Table 27.—*Measurements (in mm) of the illustrated pedicle valves of* Eudoxina subrotunda *(Weller).*

Specimen no.	Locality	Length	Width	Thickness
Lectotype				
U.I. X-94	Burlington, Iowa	+38.5	+46.4	15.5
Referred specimens				
IGS 80P63	SL393	31.1	+32.5	11.3
IGS 80P64	SL393	27.2	+32.2	8.0
CM 34709	SL393	22.6	27.2	8.5
IGS 80P65	SL393	20.6	22.3	8.3

of this genus, *Eudoxina maplensis* (Weller, 1914), also from the English River Sandstone. It differs from *Eudoxina subrotunda* (Weller) in having subangular lateral extremities, an elongate outline, more weakly developed fold and sulcus, and the flanks curve abruptly to the lateral margins.

Small specimens of the type species of the genus, *Eudoxina media* (Lebedev), from the lower Tournaisian of the Soviet Union and as illustrated by Poletaev (1975:pl. 6, fig. 1, 2, 5), are similar to some medium sized English River and Glen Park specimens, although the ribbing is slightly finer. The largest specimens of *Eudoxina media,* such as those illustrated by Kalashnikov (1974:pl. 52), are much larger than those of *E. subrotunda.* Internally, the Soviet species seemingly lacks a striate cardinal process, or at least one has not been described. The other described Russian species of this genus are less similar to *Eudoxina subrotunda.*

Distribution.—This is one of the most common brachiopod species in the English River Sandstone in the vicinity of Burlington, Iowa. In the Glen Park Formation, it occurs only at locality SL393 where 29 disarticulated specimens have been recovered.

Superfamily Spiriferacea King
Family Delthyrididae Waagen
Subfamily Tylothyridinae Carter
Genus ***Tylothyris*** North, 1920

Tylothyris missouriensis (Weller, 1906)
Fig. 18.26–18.50

v*1906 *Delthyris missouriensis* Weller, p. 445–446, pl. 6, fig. 23–26.
v.1906 *Delthyris suborbicularis* Weller, p. 446–447, pl. 6, fig. 27–28.
v.1914 *Delthyris missouriensis* Weller: Weller, p. 302–303, pl. 36, fig. 9–14.
v.1914 *Delthyris suborbicularis* Weller: Weller, p. 303–304, pl. 36, fig. 8.

Table 28.—*Measurements (in mm) of the figured types and other specimens of* Tylothyris missouriensis *(Weller) from the Glen Park Formation of Missouri and Illinois.*

Specimen no.	Locality	Length	Width	Thickness	Ribs/flank
	Brachial valves				
Lectotype					
FMNH UC11351	SL397	8.6	13.7	3.9	4
Paralectotype					
FMNH UC11351	SL397	6.1	9.8	2.1	4
Non-type					
CM 34713	SL395	9.6	±20.0	4.9	5
IGS 80P66	SL393	9.7	15.2	4.5	4
IGS 80P67	SL393	8.1	14.7	3.8	4
IGS 80P68	SL393	7.1	13.1	2.5	4
	Pedicle valves				
Paralectotypes					
FMNH UC11351	SL397	10.0	12.6	5.2	4
FMNH UC11351	SL397	6.9	8.2	3.8	5
Non-type					
CM 34712	SL395	8.9	15.5	4.5	7
IGS 80P69	SL393	10.3	11.9	4.6	5
IGS 80P70	SL393	8.6	12.3	4.9	5
IGS 80P71	SL393	8.2	11.3	3.9	5

v.1938*a* *Delthyris clarksvillensis* (Winchell): Branson, p. 137, pl. 16, fig. 9, 10.
v.1938*a* *Delthyris suborbicularis* Weller: Branson, p. 136–137, pl. 16, fig. 12, 13.
?1944 *Tylothyris missouriensis* (Weller): Cooper, p. 323, pl. 122, fig. 11–14.
?1967 *Tylothyris* cf. *T. missouriensis* (Weller): Carter, p. 362, pl. 34, fig. 9.

Lectotype.—Designated herein, a brachial valve, Fig. 18.30–18.31, FMNH UC11351, from locality SL397. This specimen was illustrated twice by Weller (1906:pl. 6, fig. 25; 1914, pl. 36, fig. 14).

Paralectotypes.—Eight specimens, FMNH UC11351, including five brachial valves, one illustrated here as Fig. 18.29, and two pedicle valves, both illustrated here as Fig. 18.26–18.28; same collection as the lectotype.

Diagnosis.—Small tylothyrididines with four to seven strong lateral plications, usually five or more, mucronate lateral extremities in large specimens, shallow rounded sulcus and low fold, strongly apsacline to nearly catacline ventral interarea, and crowded lamellose growth lamellae numbering about 2.7 to 4.3 per millimeter on the middle of the flanks.

Remarks.—Small specimens of this species are very difficult to distinguish from small specimens of *Tylothyris clarksvillensis* (Winchell) from the

Louisiana Limestone of Missouri. Both have three or four lateral plicae, slightly rounded lateral extremities, and almost catacline ventral interareas. They can be distinguished, if at all, only by the more crowded growth lamellae in *Tylothyris missouriensis* (Weller). However, large specimens of these species, although rare, are readily differentiated. Large pedicle valves of *Tylothyris missouriensis* (Weller) retain their high angled almost catacline interarea and develop mucronations at the lateral extremities. Large pedicle valves of *T. clarksvillensis* (Winchell), on the other hand, retain their non-mucronate lateral extremities but develop almost orthocline ventral interareas.

In his original description of the Glen Park Limestone faunas, Weller proposed two species of delthyridids, including the species discussed above and another, *Delthyris suborbicularis,* based upon a holotype and one other poor specimen. The holotype differs from most specimens of *Tylothyris missouriensis* (Weller) mainly in the possession of a less inflated pedicle valve, five or six lateral plicae, and a flattened moderately apsacline ventral interarea. Each of these characters is present, alone or in combination, in individual pedicle valves in larger collections of *Tylothyris missouriensis* (Weller). For this reason the writer considers it likely that *Delthyris suborbicularis* Weller is merely a rare morphological variant of *Tylothyris missouriensis* (Weller).

Distribution.—This is a moderately to very common species at the following localities: SL397, SL395, SL393, and SL396. It is rare at SL394 (two speeimens).

Family Spiriferidae King
Subfamily Prospirinae Carter
Genus ***Parallelora*** Carter, 1974

Parallelora nupera, new speeies
Fig. 20.1–20.42, 21

Holotype.—CM 34715, Fig. 20.6–20.10, collected from locality SL392 by the author, May 1984.

Paratypes.—CM 34714, 34716–34721, Fig. 20.1–20.5, 20.11–20.42, same collection as the holotype.

Description.—Medium size for genus, strongly and subequally biconvex; wider than long in all growth stages; outline transversely subovate; lateral extremities mucronate in juveniles, mucronations sometimes suppressed in large adults; maximum width attained at hingeline in juveniles, near midlength in adults; fold and sulcus narrow, shallow; anterior commissure weakly uniplicate; ornament consisting of 23–30 simple or bifurcating rounded costae, usually about 23–25, on the flanks in large adults, and about 5–10, usually 7 or 8, in the sulcus; growth varices irregularly developed; micro-ornament consisting of faint capillae, about 15 per millimeter, and sinuous regularly spaced growth lines.

Table 29.—*Measurements (in mm) of the types of* Parallelora nupera *n. sp. from locality SL392.*

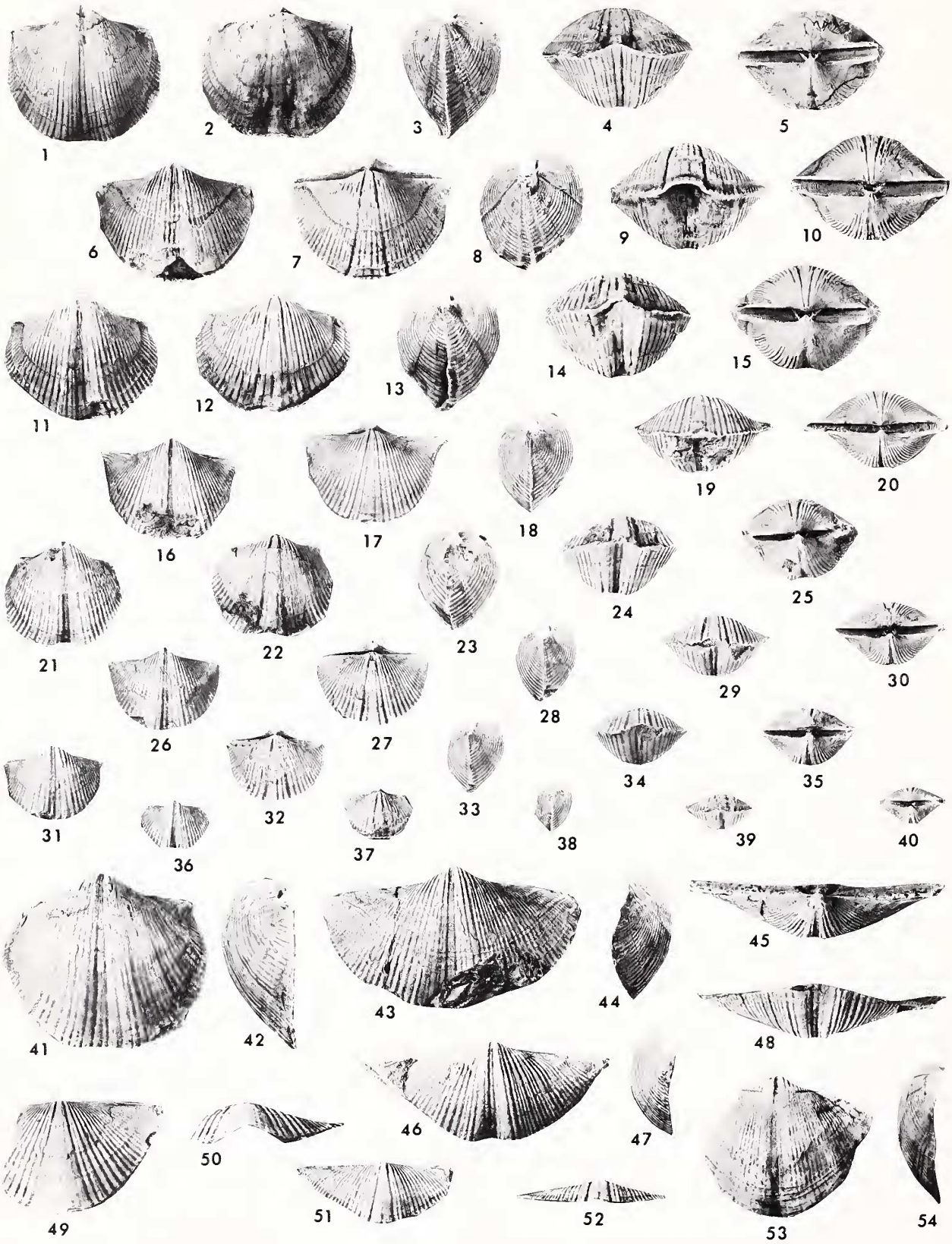
Specimen no.	Length	Width	Thick-ness	Ribs/ sulcus	Ribs/ flank
CM 34722	31.1	36.9	—	10	27
CM 34714	24.6	27.7	18.4	7	28
CM 34715	22.5	+28.7	19.4	5	26
CM 34716	22.9	27.7	18.9	9	23
CM 34717	18.3	+25.4	13.8	7?	24
CM 34718	18.8	21.3	14.5	6	19
CM 34719	15.1	20.0	11.3	3	21
CM 34720	13.6	17.5	10.4	3	18
CM 34721	9.3	+10.9	6.9	3	14

Pedicle valve moderately inflated, strongly convex in lateral profile, most convex in umbonal region; beak small, incurved; umbonal region moderately broad, projecting posteriorly moderately beyond hingeline; flanks weakly to moderately convex, sloping evenly to antero-lateral margins, except for flexures near cardinal extremities; interarea strongly apsacline to nearly catacline, low, weakly concave, vertically grooved, sharply defined by beak ridges parallel to hingeline; hingeline denticulate; delthyrium slightly narrower than high, partially occluded by stegidial plates; sulcus originating in umbonal region near beak as narrow groove, becoming wider but remaining shallow throughout, flaring slightly near anterior margin; median sulcal costa originating anterior to beak in umbonal region, becoming broader than other sulcal costae anteriorly, often bifurcating near anterior margin in large adults; lateral sulcal costae bifurcating from sulcus-bounding costae and also may bifurcate once in large specimens; lateral costae usually simple, occasionally bifurcating randomly over any portion of flanks, becoming very narrow and faint near lateral extremities; interior with short diverging dental adminicula which fuse with dental flanges at moderately high angle; teeth small, broad; short thick subdelthyrial plate or callus present at apex of delthyrium; muscle field moderately impressed.

Brachial valve slightly thinner than opposite valve, with moderately gibbous umbonal region and inconspicuous beak; dorsum evenly convex, flanks sloping evenly to antero-lateral margins, becoming moderately concave and compressed posteriorly; dorsal interarea very low, defined by angular beak ridges parallel to hingeline, orthocline or slightly apsacline; fold originating at beak as narrow costa defined by fold-bounding grooves that are deeper than intercostal furrows, becoming broader anteriorly but never rising much above flanks; interior with striate cardinal process, wide sockets, and spiralia composed of at least 14 whorls; other internal details not observed.

Distinguishing characters.—This species is characterized by its subovate adult outline, with about 23 to 30 costae on each flank, several of which may bifurcate, and about 5–10 costae in the sulcus, a median sulcal costa that usually bifurcates in adults, and lateral sulcal costae that may bifurcate in large adults.

Remarks.—*Parallelora nupera* n. sp. is similar to *Parallelora marionensis* (Shumard, 1855), from the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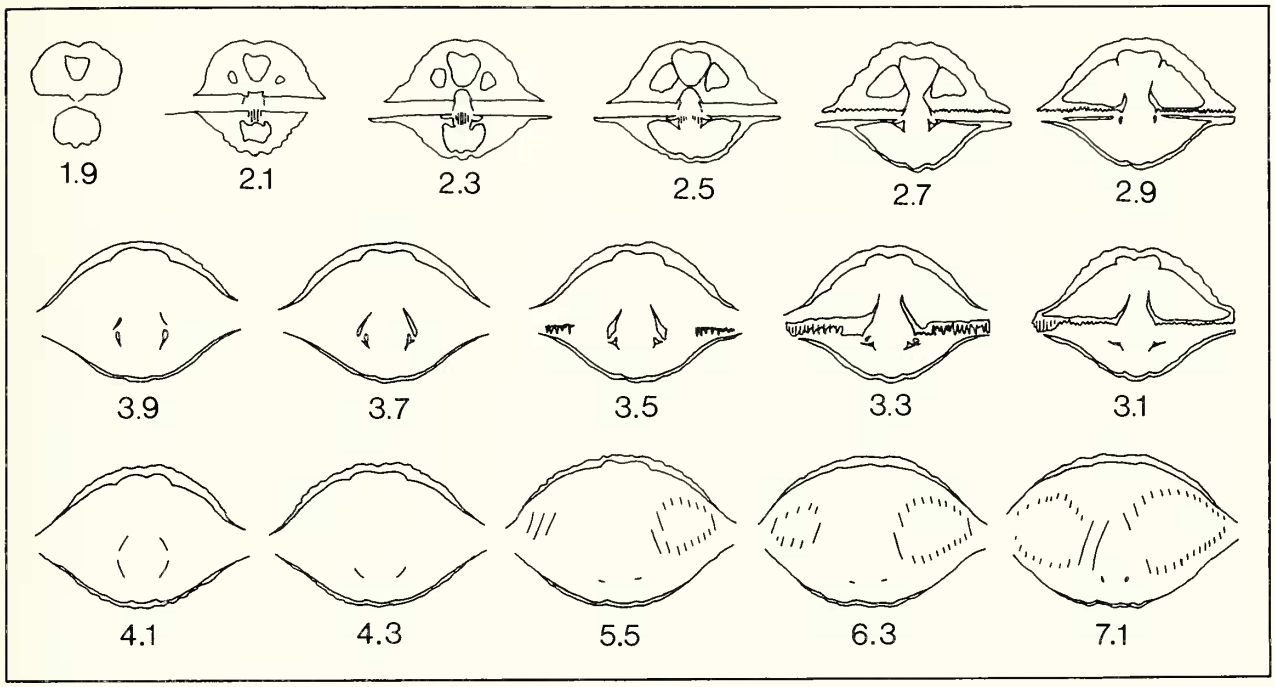

Fig. 21.—Transverse serial sections of *Parallelora nupera* n. sp. from SL392, CM 34724. Numbers refer to distance in mm from ventral beak. ×1.5.

Louisiana Limestone of Missouri and Illinois. The latter differs from *Parallelora nupera* n. sp. in having fewer costae on the flanks, about 20 per flank, and fewer costae in the sulcus, usually three or five. In addition, the median suleal costa of *P. marionensis* rarely bifurcates, even in the largest shells, and the lateral sulcal costae never bifurcate as far as can be determined by this writer. The outline of *P. marionensis* can be subovate but almost never in the largest shells, which are usually more transverse than large specimens of *Parallelora nupera* n. sp.

Distribution.—This species has very limited distribution in the Glen Park Formation, occurring at only three localities. It is abundant at locality SL392 (110 specimens), and rare at localities SL393 (4 specimens) and SL394 (5 specimens).

Genus ***Unispirifer*** Campbell, 1953

Unispirifer senex, new species
Fig. 20.43–20.54, 22

Holotype.—A large pedicle valve, IGS 80P72, Fig. 20.43–20.45, from locality SL393, collected by C. Collinson.

Paratypes.—Two large pedicle valves and a large brachial valve, IGS 80P73–80P75, Fig. 20.46–20.50, 20.53–20.54, same collection as the holotype; one small brachial valve, CM 34723, Fig. 20.51–20.52, collected by the author from locality SL393.

Description.—Medium size for genus, unequally biconvex with pedicle valve more inflated than brachial valve; outline acutely subtriangular in small adults and juveniles, becoming more elongated and subsemicircular in large adults; greatest width along

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Fig. 20.—Spiriferids. 19.1–19.42, *Parallelora nupera* n. sp.; 19.1–19.40, ventral, dorsal, lateral, anterior and posterior views of a growth series of eight specimens, including the holotype (19.6–19.10), CM 34714–34721, respectively; 19.41, 19.42, ventral and lateral views of a large pedicle valve, CM 34722; all from SL392; all ×1. 19.43–19.54, *Unispirifer senex* n. sp.; 19.43–19.45, ventral, lateral and posterior views of the holotype, IGS 80P72; 19.46–19.48, ventral, lateral and anterior views of a pedicle valve, IGS 80P73; 19.49–19.52, dorsal and anterior views of two brachial valves, IGS 80P74 and CM 34723, respectively; 19.53, 19.54, ventral and lateral views of an elongate pedicle valve, IGS 80P75; all from SL393; all ×1.

Table 30.—*Measurements (in mm) of the types of* Unispirifer senex *n. sp. from locality SL393.*

Specimen no.	Length	Width	Thickness	Ribs/fold-sulcus	Ribs/flank
		Pedicle valves			
IGS 80P72	±25.2	45.9	10.7	8	29
IGS 80P73	17.7	45.1	9.0	5	27
IGS 80P75	25.3	±36.0	9.3	7	27
		Brachial valves			
IGS 80P74	20.1	±37.2	6.0	10	+22
CM 34723	11.1	±31.6	4.3	6	24

hingeline in all growth stages; cardinal extremities alate or slightly mucronate, subangular; fold and sulcus narrow and well defined but shallow and weakly developed; anterior commissure weakly uniplicate; ornament consisting of 24–29 rounded costae on each flank in large adults and about 5–10 in the sulcus; costae on flanks mostly simple but commonly with about one to three bifurcating umbonal costae; anterior bifurcations very rare; median sulcal costa simple in small specimens but may bifurcate in large adults; simple lateral sulcal costae bifurcate from sulcus-bounding costae; strong irregularly spaced growth varices present; micro-ornament consisting of faint capillae and sinuous regularly spaced growth lines; shell substance thick in umbonal regions of both valves.

Pedicle valve moderately inflated, most convex in umbonal region with maximum thickness attained near or slightly posterior to midlength; umbonal region moderately broad and protruding moderately posterior to hingeline; beak small, slightly incurved; flanks gently convex, sloping evenly to antero-lateral margins, becoming reflexed and weakly concave near lateral extremities; beak ridges angular, sharply defining ventral interarea; interarea weakly concave, of moderate height, acutely triangular, truncated at lateral extremities, apsacline in small adults, becoming orthocline in large specimens; hingeline vertically grooved, denticulate; delthyrium wide; deltidial plates not observed; sulcus originating as medial groove at beak, becoming rounded anteriorly, remaining shallow for entire length; sulcus-bounding costae of normal size or slightly enlarged; interior with short stout dental adminicula fused with dental flanges at moderately high angle; teeth small; adminicula enclose deeply impressed diductors and raised narrow adductor ridges; thick callus present in entire posterior region.

Brachial valve less inflated than pedicle valve, most convex in umbonal region; flanks gently convex from front to rear, flattened or weakly concave in anterior profile, sloping gently to antero-lateral margins; lateral extremities slightly compressed; dorsal beak tiny and inconspicuous; dorsal interarea not observed; fold originating as narrow costa in umbo, defined only by fold-bounding grooves, becoming broader and rising very little above flanks anteriorly, clearly delineated by disproportionately deep fold-bounding grooves; interior with striate cardinal process composed of numerous thin vertical plates and supported by thick umbonal callus; sockets wide, weakly supported by thin inner and outer socket ridges; brachidial details not observed; dorsal muscle field moderately impressed.

Distinguishing characters.—This species is distinguished by its ontogenic tendency to become more elongated in large specimens with its outline changing from subtrigonal to subsemicircular and its lateral extremities changing from acutely alate or slightly mucronate to subrounded. It is further characterized by its rounded shallow narrow sulcus with a median sulcal costa that may bifurcate in large adults, 24 to 29 lateral costae, several of which may bifurcate in the umbonal region, and a low dorsal fold that is clearly delimited by deep fold-bounding grooves.

Remarks.—*Unispirifer senex* n. sp. bears similarity to both *Spirifer* cf. *S. greenockensis* Brown and the specimens described as *Spirifer* sp.? by Rodriguez and Gutschick (1967:377–379) from the Sappington Formation of Montana. It differs slightly from the first Sappington species in having a slightly narrower fold-sulcus with fewer sulcal costae and the costae on the flanks bifurcate in the umbonal region, not near midlength as in the Sappington species. The other Sappington form, *Spirifer* sp.?, has about 35 lateral costae, many of which bifurcate anterior to midlength, and acutely angular or mucronate lateral extremities in the largest specimens, giving it a very transverse outline, quite unlike *Unispirifer senex* n. sp.

In its tendency toward elongation of the shell in late ontogeny and the presence of a strong median sulcal costa that tends to bifurcate, *Unispirifer senex* n. sp. is similar to *Unispirifer greenockensis* (Brown) from the Banff Formation of Alberta as redescribed by Carter (1987). The latter differs from *Unispirifer senex* n. sp. in having slightly fewer lateral costae, a more poorly defined sulcus with more numerous freely bifurcating lateral sulcal costae and an unusually coarse bifurcating median sulcal costa.

Distribution.—The description given above is based on a single collection of 31 disarticulated valves from locality SL393.

Family Brachythyrididae Frederiks
Subfamily Brachythyridinae Frederiks
Genus ***Brachythyris*** M'Coy, 1844

Brachythyris hortonensis, new species
Fig. 18.19–18.25

Holotype.—A large pedicle valve, CM 34711, Fig. 18.24–18.25, collected at locality SL392 by the author, May 1984.

Paratype.—A crushed but otherwise complete smaller specimen, CM 34710, Fig. 18.19–18.23, same collection as the holotype.

Description.—Medium size for genus, wider than long, transversely subelliptical in outline, maximum width attained near

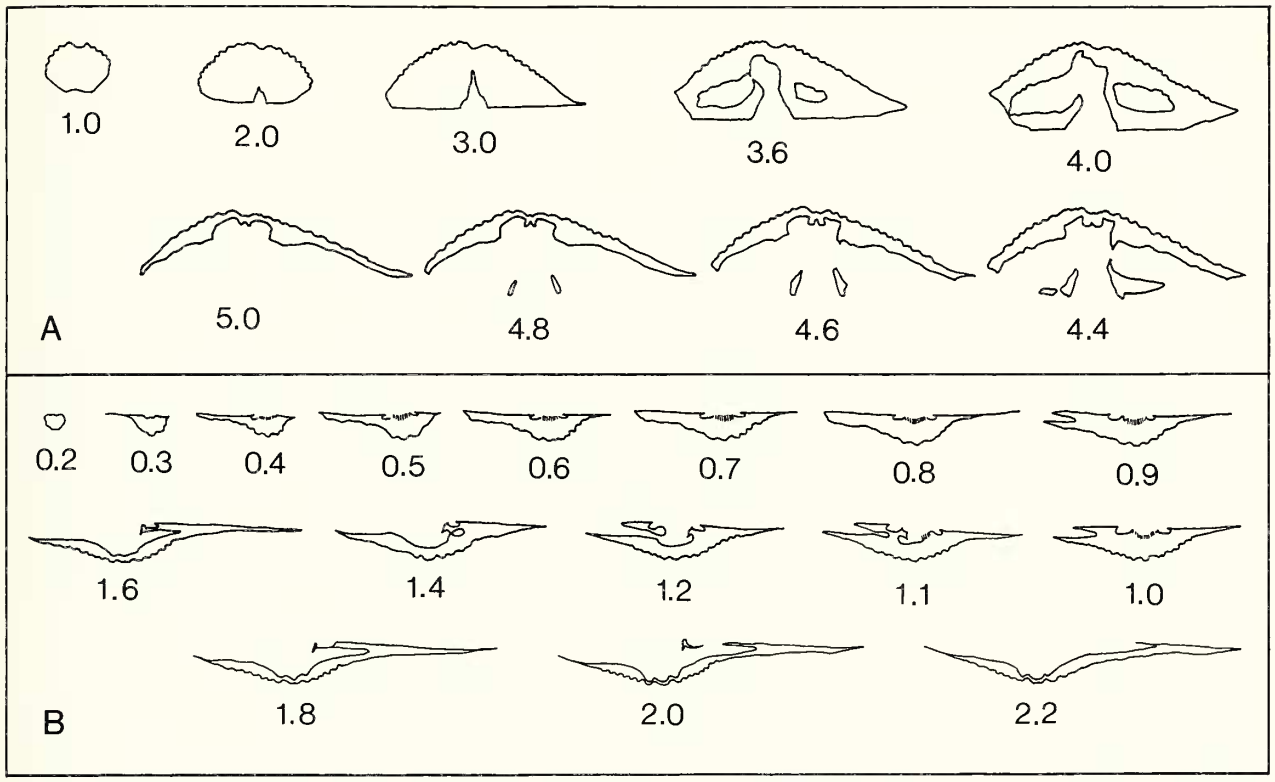

Fig. 22.—Transverse serial sections of *Unispirifer senex* n. sp. from SL393. A, medium sized pedicle valve, IGS 80P76; B, medium sized brachial valve, IGS 80P77, both ×1.5. Numbers refer to distance in mm from beak.

midlength; lateral extremities rounded; fold and sulcus of moderate width; anterior commissure weakly uniplicate; ornament consisting of about 11 coarse rounded simple lateral plicae in large shells, and three or five in sulcus, median costa being broader and more flattened than lateral suleal costae; micro-ornament, if any, not observed.

Pedicle valve slightly more inflated than brachial valve, most inflated in umbonal region, almost evenly convex in lateral profile; umbonal region broad, extending well posterior to hingeline; beak small, slightly incurved; venter slightly arched, flanks more weakly convex, sloping evenly to antero-lateral margins; lateral extremities defined by slightly concave flexures, moderately compressed; ventral interarea small, concave, acutely triangular, defined by weak beak ridges, apsacline; delthyrium about as wide as high, partially occluded by thin low posteriorly directed deltidial plates; suleus originating at beak as shallow narrow groove, becoming gradually broader and moderately deeper anteriorly but remaining shallow throughout; median sulcal costa slightly rounded, almost flat, broader than lateral sulcal costae; one or two pairs of lateral sulcal costae originate by bifurcation from sulcus-bounding costae; interior lacking dental adminicula; other internal details not observed.

Brachial valve with slightly gibbous umbo but almost evenly convex in lateral profile; flanks moderately convex, sloping evenly to antero-lateral margins; lateral extremities slightly compressed; fold originating in umbonal region as narrow low plica, becoming broader anteriorly but rising only slightly above flanks at front margin, defined mainly by fold-bounding grooves that are slightly deeper than those of other lateral intercostal furrows; ribbing lacking on fold but distinct medial groove extending from umbonal region to anterior margin; dorsal interarea and internal details not observed.

Distinguishing characters.—This species is characterized by its transversely subelliptical outline, about 11 simple plicae on the flanks, three plicae in the sulcus, with a well defined weakly rounded median sulcal costa, and a distinct dorsal median groove on the fold.

Remarks.—Most other Lower Mississippian species of the genus *Brachythyris* lack a rounded median sulcal costa and can be distinguished on that basis alone. Carter (1987) described a small specimen of similar form to *Brachythyris hortonensis* n. sp. as *Brachythyris* cf. *B. chouteauensis* (Weller) from the Banff Formation of Alberta. Like the Glen Park species this specimen is transversely subovate with

Table 31.—*Measurements (in mm) of the types of* Brachythyris hortonensis *n. sp. from locality SL392.*

Specimen no.	Length	Width	Thickness
Holotype			
CM 34711	24.9	32.7	10.2
Paratype			
CM 34710	20.5	26.9	+15.3

about 11 plicae on the flanks and three in the sulcus. It differs in having broader shoulders, lacks a dorsal median groove in the fold, is much smaller, and the fold is higher at the front.

The common mid-Kinderhookian species, *Brachythyris peculiaris* (Shumard), is not similar to this Glen Park species, having a rhomboidal outline, fewer plicae, and a narrow smooth sulcus, in addition to being much smaller. *Brachythyris chouteauensis* (Weller), of Late Kinderhookian and Early Osagean age, has a much more inflated pedicle valve, broader shoulders, a stronger fold-sulcus, and lacks a median sulcal costa.

Brachythyris hortonensis n. sp. is similar in size, shape and ornamentation to *Brachythyris planulata* Roberts, 1971, from the Ningbing Limestone (Tournaisian) of western Australia. It differs from *Brachythyris hortonensis* n. sp. in having broader shoulders, the median sulcal costa tends to be broader and flatter, and there may be more pairs of lateral sulcal costae.

Distribution.—This description is based on only three specimens, the holotype, a paratype, and a large fragmentary brachial valve, all from locality SL392.

Superfamily Reticulariacea Waagen
Family Elythidae Frederiks
Genus ***Kitakamithyris*** Minato, 1951

Kitakamithyris cooperensis (Swallow, 1860)
Fig. 23.21–23.45

1860 *Spirifer cooperensis* Swallow, p. 643. (types lost)
1900 *Reticularia cooperensis* (Swallow): Weller, p. 80–81, pl. 2, fig. 1.
1914 *Reticularia cooperensis* (Swallow): Weller, p. 428–429, pl. 75, fig. 21–33.
1958 *Reticularia cooperensis* (Swallow): Sanders, p. 58–59, pl. 6D, fig. 21–30.
1967 *Reticularia? cooperensis* (Swallow): Carter, p. 405–408, pl. 40, fig. 1–7; textfig. 41.

Types.—Swallow's types, deposited at the University of Missouri, were lost in a fire in 1892.

Diagnosis.—Medium sized transverse elythiids with a subelliptical outline, weakly developed fold and sulcus, and moderately narrow ventral umbonal region that extends slightly posterior to the hingeline. Internally, both valves bear a low thin median ridge that extends to about midlength.

Remarks.—The synonomy given above is not intended to be complete but is rather a guide to several references that provide complete descriptions of the external and internal morphology of this widely identified species. Also, as noted in the synonomy, Weller (1900) identified this species in the English River Sandstone at Burlington, Iowa. The Glen Park Limestone specimens are closely similar to authentic Chouteau Limestone specimens except for being moderately larger with slightly less protuberent ventral umbones. *Kitakamithyris cooperensis* (Swallow) from the Chouteau varies so much in these parameters they seem to be of little taxonomic importance. As Sanders (1958) and Carter (1967) have pointed out this species lacks a true median septum in the brachial valve but it may have a variably developed low dorsal median ridge. For this reason it is here assigned to the genus *Kitakamithyris* Minato, 1951. *Reticularia setigera* Hall var. *internascens* Girty, 1928, is probably assignable to the genus *Kitakamithyris* Minato. Aside from its much younger age it differs from *Kitakamithyris cooperensis* (Swallow) in being larger, generally more transverse, and, according to Girty (1928:93) the dental plates differ in size and placement.

Distribution.—*Kitakamithyris cooperensis* (Swallow) is not a common fossil in the Glen Park Formation. Only three collections were found at localities SL392 (16 specimens), SL393 (5 specimens) and SL394 (2 specimens).

Family Martiniidae Waagen
Genus ***Eomartiniopsis*** Sokolskaya, 1941

Eomartiniopsis kinderhookensis, new species
Fig. 24.35–24.47, 25

Holotype.—Fig. 24.35–24.38, CM 34737, collected by the author from locality SL392, May 1984.

Paratypes.—Two pedicle valves, Fig. 24.39–24.42, CM 34738, 34739; a large brachial valve, Fig. 24.43, CM 34740; a small shell, Fig. 24.44–24.47, CM 34741; all from the same collection as the holotype.

Description.—Medium size for genus, subequally biconvex, transversely subovate in outline; lateral extremities rounded, hingeline brachythyrid; maximum width attained near or slightly posterior to midlength; fold and sulcus narrow and well developed in most specimens; anterior commissure uniplicate; ornamentation lacking except for irregularly spaced growth varices, faint closely and regularly spaced growth lines, and very weak obscure ribs on flanks of some specimens; spalled surfaces may show faint radial striations or fine dense pits or shagreen ornament; shell substance impunctate.

Pedicle valve most convex in umbonal region; beak small, incurved; umbonal region moderately broad, only moderately extended posterior to hingeline; flanks gently convex, sloping evenly to antero-lateral margins; lateral extremities slightly compressed; sulcus well defined, narrow, rounded, originating at beak,

becoming wider and deeper anteriorly, producing moderate tongue; ventral interarea very small, triangular, apsacline, poorly defined by well rounded beak ridges; delthyrium about as wide as high, deltidial plates not observed; interior with thin closely set, slightly diverging dental adminicula that extend foward about one-fourth length of valve; teeth small; ventral muscle field slightly impressed.

Brachial valve usually slightly less inflated than pedicle valve; umbonal region broad, moderately inflated, slightly tumid, protruding posteriorly slightly; dorsal beak tiny, narrow, inconspicuous; dorsal interarea, if present, not observed; flanks as in opposite valve, lateral extremities slightly compressed; dorsum arched; fold originating in umbonal region as weak rounded plica, becoming well defined and rising moderately above flanks at anterior margin, narrow; interior with unsupported striate cardinal process, wide sockets, with medially concave crural bases attached to inner socket ridges; brachidium not observed; dorsal muscle field not impressed.

Distinguishing characters.—This species can be differentiated by its small ventral umbo that protrudes posteriorly very little beyond the hingeline and its well defined narrow fold and sulcus.

Remarks.—Early Kinderhookian *Eomartiniopsis* or similar genera are not reported in North America. *Eomartiniopsis girtyi* (Branson, 1938) from the Chouteau Limestone of central Missouri and the Chappel Limestone of eentral Texas is much larger, more transverse, has better defined ribbing, a wider fold and sulcus, and the ventral umbo is much more protuberent. *Eomartiniopsis rostrata* (Girty, 1899) from the Lodgepole Limestone of the northern Cordilleran region, the Gilmore City Limestone of northern Iowa, the Banff Formation of Alberta, and the St. Joe Limestone of Arkansas and Oklahoma has a shallow wide poorly defined sulcus with a high wide rounded fold and large ventral tongue. The outline and development of the ventral umbo is highly variable in this species, but it is usually broad, often flattened, and protruding well beyond the hingeline with little evidence of a sulcus or merely a shallow medial groove. Furthermore, the flanks are invariably smooth with no trace of ribbing.

Table 32.—*Measurements (in mm) of the types of* Eomartiniopsis kinderhookensis *n. sp. from locality SL392.*

Specimen no.	Length	Width	Thickness
Holotype			
CM 34737	21.4	21.5	15.7
Paratypes			
CM 34741	17.0	19.2	12.4
	Pedicle valves		
CM 34738	22.9	+27.6	+8.3
CM 34739	22.4	+24.1	9.6
	Brachial valve		
CM 34740	20.2	25.0	9.0

Eomartiniopsis helenae Sokolskaya, 1941, from the Tournaisian of the Moscow Basin (Malevsky Horizon), is similar in outline and in the well-defined narrow fold and sulcus. It differs from *Eomartiniopsis kinderhookensis* n. sp. in having a more protuberent ventral umbo and internally it has short tabellae.

Assignment of this species to the genus *Eomartiniopsis* Sokolskaya, 1941, is arguable. As Brunton (1984*b*:95) has pointed out, there are several martiniid generic names in the literature that possibly could apply to smooth or nearly smooth species with dental adminicula. Two generic names seem to be available for these early Carboniferous species, namely *Eomartiniopsis* Sokolskaya, 1941, and *Merospirifer* Reed, 1948. The former was described as possessing short incipient septal plates but the single thin section illustrating these septal plates (Sokolskaya, 1941:pl. 12, fig. 1b) shows crural bases approaching but not touching the floor of the valve. The type species of this genus, *Eomartiniopsis elongata* Sokolskaya, 1941, must be thoroughly redescribed and illustrated before one can judge the taxonomic significance of these septal plates. *Merospirifer* Reed, 1948, has been recently discussed and reillustrated by Brunton (1984*b*:95–97, fig. 147–149).

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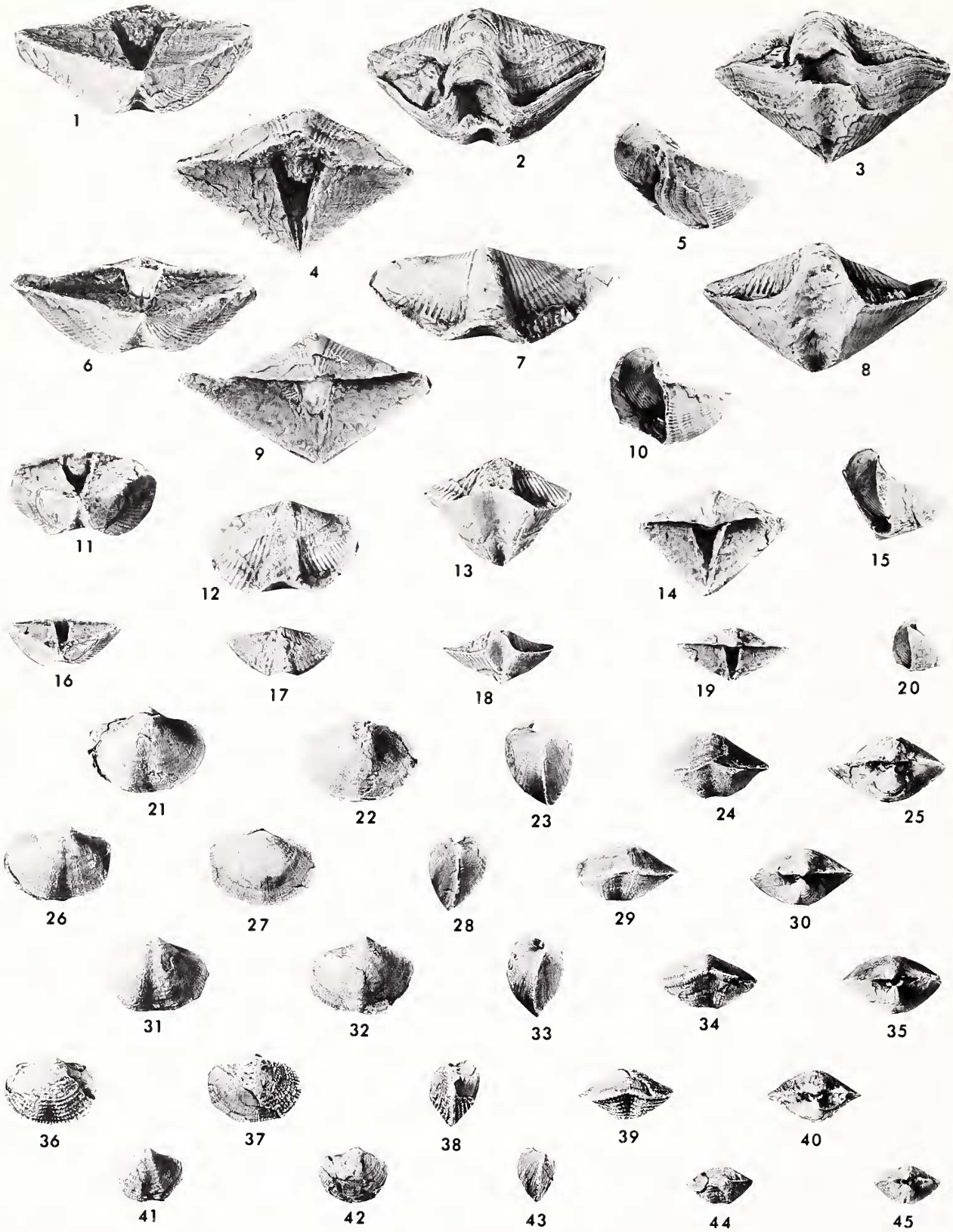
Fig. 23.—Syringothyridids and reticulariids. 22.1–22.20, *Syringothyris extenuata* (Hall), ventral, dorsal, anterior, posterior and lateral views of four complete but moderately crushed specimens from SL392, CM 34725–34728, ×1; 22.21–22.45, *Kitakamithyris cooperensis* (Swallow), ventral, dorsal, lateral, anterior and posterior views of five specimens from SL392, CM 34729–34733, ×1.

Fig. 24.—Terebratulids and reticulariids. 23.1–23.34, *Hamburgia typa* Weller; 23.1–23.18, ventral, dorsal and lateral views of six small complete shells from SL393, IGS 80P78–80P83, ×3; 23.19, a large pedicle valve showing color banding from SL395, the lectotype, FMNH UC14245, ×1; 23.20–23.34, ventral, dorsal, lateral, anterior and posterior views of three larger complete shells from SL393, CM 34734–34736, ×1. 23.35–23.47, *Eomartiniopsis kinderhookensis* n. sp.; 23.35–23.38, ventral, dorsal, lateral and anterior views of the holotype, CM 34737; 23.39–23.42, ventral and anterior views of two pedicle valves, CM 34738, 34739; 23.43, a large brachial valve, CM 34740; 23.44–23.47, ventral, dorsal, lateral and anterior views of a small nearly complete shell, CM 34741; all from SL392; all ×1.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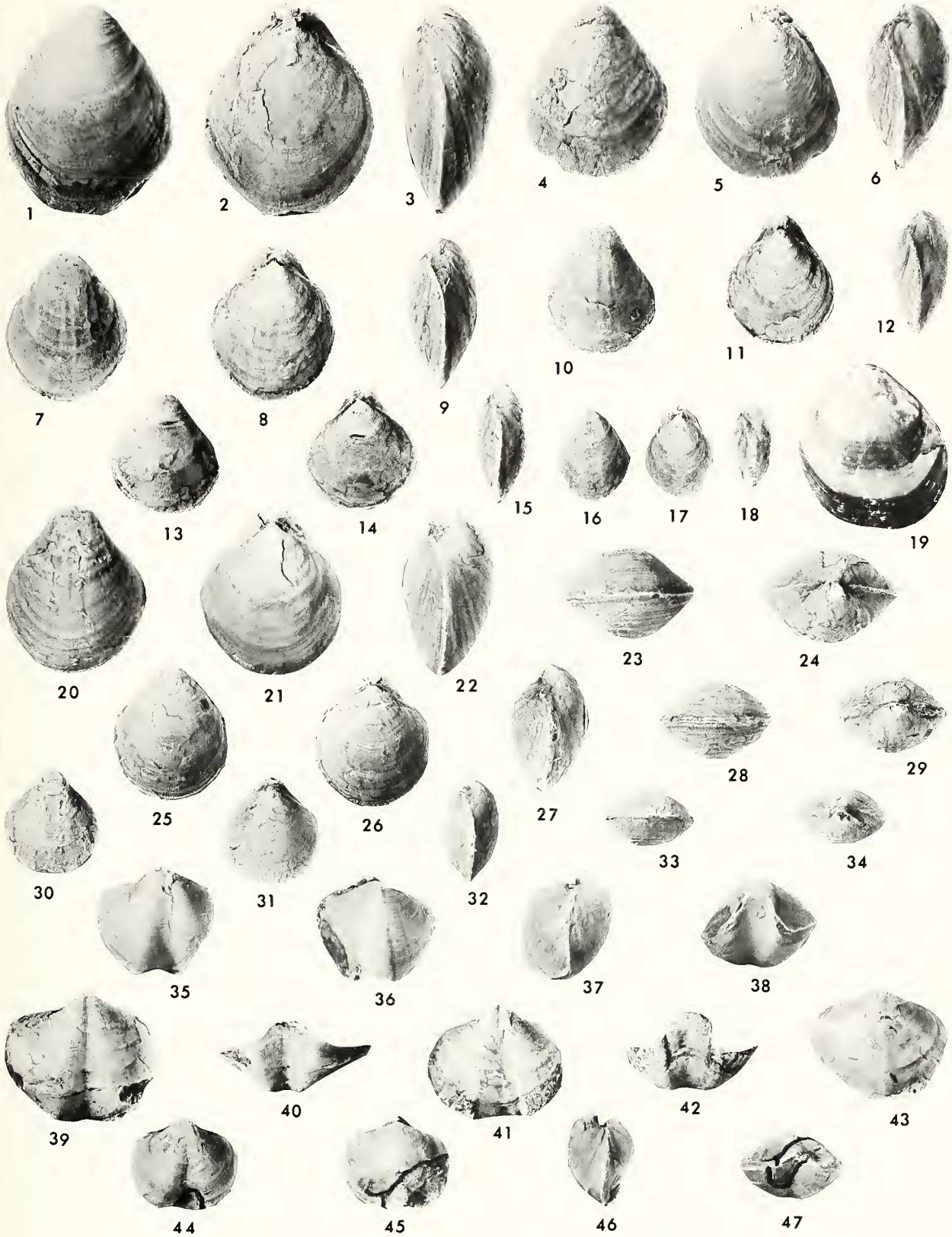
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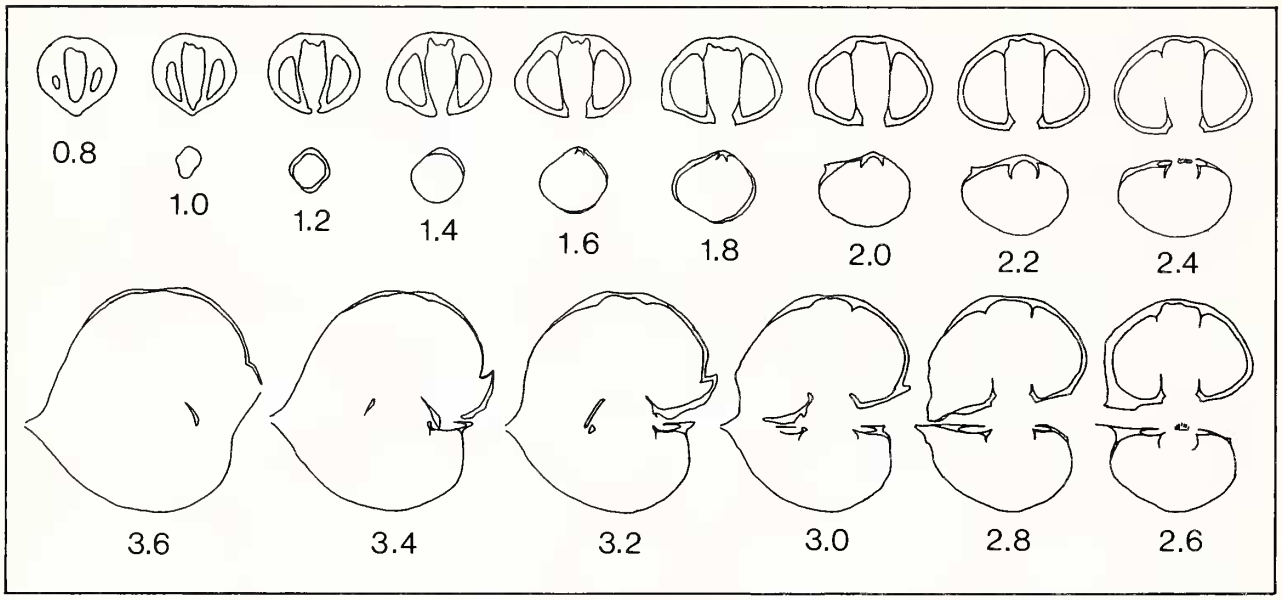


Fig. 25.—Transverse serial sections of *Eomartiniopsis kinderhookensis* n. sp. from SL392, CM 34742. Numbers refer to distance in mm from ventral beak. ×1.5.

Although this genus does not seem to bear septal plates, crural plates, tabellae, or similar structures, Fig. 149 shows a wide dorsally descending hingeplate which, with minor modification, could readily touch the floor of the valve. Johnson (1971:318) has shown that in at least some reticulariaceans the presence or absence of crural plates is not even of specific importance. For this reason, this new Glen Park species was assigned to *Eomartiniopsis* simply because the genus name has seniority.

Distribution.—The description given above is based on a single collection of 35 specimens, mostly disarticulated valves, from locality SL392. Two other valves come from locality SL394.

Order Spiriferinida Ivanova
Suborder Spiriferinidina Ivanova
Superfamily Syringothyridacea Frederiks
Family Syringothyrididae Frederiks
Subfamily Syringothyridinae Frederiks
Genus ***Syringothyris*** Winchell, 1863

Syringothyris extenuata (Hall, 1858)
Fig. 23.1–23.20

1858 *Spirifer extenuatus* Hall, p. 520, pl. 7, fig. 6.
1900 *Syringothyris extenuata* (Hall): Weller, p. 77–80, pl. 2, fig. 1–3, textfig. 1.
1914 *Syringothyris extenuata* (Hall): Weller, p. 386–388, pl. 72, fig. 5–12.

Holotype.—Whereabouts unknown.

Diagnosis.—Moderate sized to small *Syringothyris* with angular alate lateral extremities and a very short pedicle valve with a consistently strongly procline flattened ventral interarea.

Remarks.—This species presumably was described from a single brachial valve from the English River Sandstone at Burlington, Iowa. This specimen, the holotype, cannot be located by the present writer. Weller (1900, 1914) recollected and redescribed the species from English River Sandstone specimens and the present identification is based upon Weller's work. Weller (1900:78) clearly differentiated *Syringothyris extenuata* (Hall) from *Syringothyris halli* Winchell, 1863, which is from the superjacent McCraney Limestone, by its larger size, angular lateral extremities, and more procline interarea. The Glen Park Formation specimens illustrated here in Fig. 22 are all nearly complete but are crushed or have broken lateral extremities. This is a common species at most Glen Park localities and many pedicle valves are available for study. There is great variation in the height, flatness and inclination of the ventral interarea, much greater than Weller suggested, although the interarea is consistently procline.

Distribution.—This is a fairly common species at the following localities: SL392 (25 specimens), SL393 (36 specimens), SL396 (10 specimens), SL397 (8 specimens), SL511 (1 specimen).

Zeugopleura, new genus

Type species.—*Spirifer jeffersonensis* Weller, 1906, from the Glen Park Limestone at Glen Park Station, Jefferson County, Missouri (locality SL397).

Other species assigned.—*Spirifer compositus* Girty, 1928, from the Riddlesburg Shale Member of the Rockwell Formation, Bedford County, Pennsylvania.

Derivation of name.—From the Greek *zeugos*—pair, and *pleuron*—rib, referring to the pair of ribs in the ventral sulcus.

Stratigraphic range.—Early Kinderhookian.

Diagnosis.—Small to medium sized syringothyrididines with a pair of costae that rarely bifurcate in the ventral sulcus, moderately high concave procline ventral interarea, rounded lateral extremities, and a small apical subdelthyrial plate.

Description.—Small to medium size, transversely subelliptical in outline, unequally biconvex; pedicle valve subpyramidal with high slightly concave procline interarea and small slightly incurved beak; brachial valve moderately convex and similar to those of other syringothyrididines; ornament consisting of numerous simple rounded costae on flanks, two rarely bifurcating costae in the flattened sulcus, three or more on moderately flattened fold, and minute elongate papillae; ventral interior with small flattened apical subdelthyrial plate, syrinx lacking; dental adminicula slender, diverging, moderately long; dorsal interior spiriferoid with unsupported cardinalia; shell substance finely endopunctate.

Comparisons.—*Zeugopleura* n. gen. can best be compared with the following syringothyridine genera: *Pseudosyrinx* Weller, 1914, *Asyrinxia* Campbell, 1957, *Plicatosyrinx* Minato, 1952, and *Verkhotomia* Sokolskaya, 1963. *Pseudosyrinx* Weller differs from *Zeugopleura* n. gen. in having a smooth fold and sulcus and a large subdelthyrial plate. *Asyrinxia* Campbell can be differentiated by its alate lateral extremities, four to six weak obscure costae on the sides of the sulcus, and it lacks a subdelthyrial plate. *Plicatosyrinx* was described by Minato (1952:163) as externally having a ribbed fold and sulcus. Internally, it is said to possess a syrinx, but lacked dental plates and median septum, the shell substance being impunctate. *Verkhotomia* Sokolskaya is a much larger, strongly biconvex genus with a relatively low apsacline ventral interarea. It may have weak ribs on the sides of the sulcus but never has a pair on the floor of the sulcus. The perideltidial areas in *Verkhotomia plena* (Hall) are narrow, not wide as in *Zeugopleura jeffersonensis* (Weller).

Table 33.—*Measurements (in mm) of the illustrated specimens of* Zeugopleura jeffersonensis *(Weller, 1906) from the Glen Park Formation.*

Specimen no.	Locality	Length	Width	Thickness	Ribs/ flank
		Pedicle valves			
Lectotype					
UC11350	SL397	17.8	22.4	10.1	10
IGS 80P84	SL393	17.9	27.8	11.8	11
IGS 80P85	SL393	17.5	27.8	11.2	12
CM 34743	SL396	16.3	27.0	9.5	12
IGS 80P86	SL393	14.4	24.2	10.0	12
IGS 80P87	SL393	11.9	14.4	6.1	8
IGS 80P88	SL393	10.3	15.3	6.5	9
		Brachial valves			
IGS 80P89	SL393	16.5	28.5	7.4	10
CM 34744	SL396	16.0	27.3	6.4	11
CM 34745	SL396	13.3	22.4	5.1	10
Paralectotype					
UC11350	SL397	15.0	+20.9	+6.7	10
IGS 80P90	SL393	14.3	24.0	5.7	10
IGS 80P91	SL393	7.6	11.6	3.7	7
IGS 80P92	SL393	7.3	10.8	3.0	7

Zeugopleura jeffersonensis (Weller, 1906)
Fig. 26.1–26.39, 27

v*1906 *Spirifer jeffersonensis* Weller, p. 444–445, pl. 6, fig. 18–22.

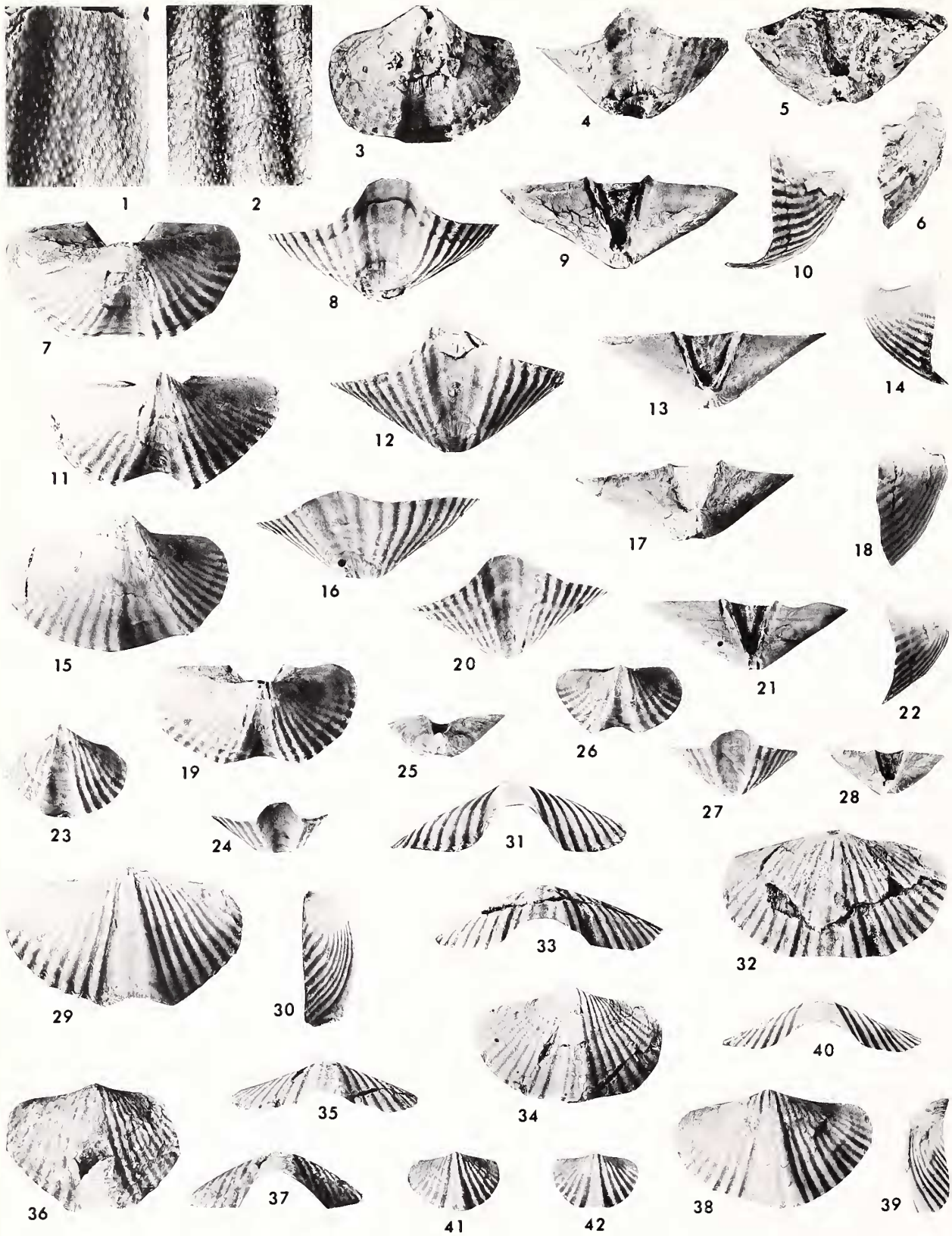
1914 *Spirifer jeffersonensis* Weller: Weller, p. 369–370, pl. 42, fig. 17–21.

1938*a* *Spirifer jeffersonensis* Weller: Branson, p. 138, pl. 16, fig. 21, 22.

Lectotype.—Designated herein, a slightly smaller than average spalled pedicle valve, FMNH UC11350, Fig. 26.3–26.6, from Glen Park, Jefferson County, Missouri, SL397; illustrated by Weller (1906:pl. 6, fig. 19, 20; 1914, pl. 42, fig. 17, 18).

Paralectotypes.—Four spalled brachial valves, FMNH UC11350, one illustrated here as Fig. 26.36–26.37, same collection as the lectotype; three illustrated by Weller (1906:pl. 6, fig. 20–22; 1914:pl. 42, fig. 19–21); one small pedicle valve, FMNH UC11350, never illustrated, same collection as above.

Description.—Smaller than average for subfamily, unequally biconvex, transversely subelliptical in outline; lateral extremities well rounded in all growth stages, maximum width usually attained near or posterior to midlength; fold and sulcus well developed and defined, anterior commissure uniplicate; ornament consisting of from 10–12 simple rounded flattened costae on the flanks, two low, rounded costae that rarely bifurcate in the sulcus, three or more obscure costae on the fold, weak irregularly spaced growth varices, very faint closely and regularly spaced growth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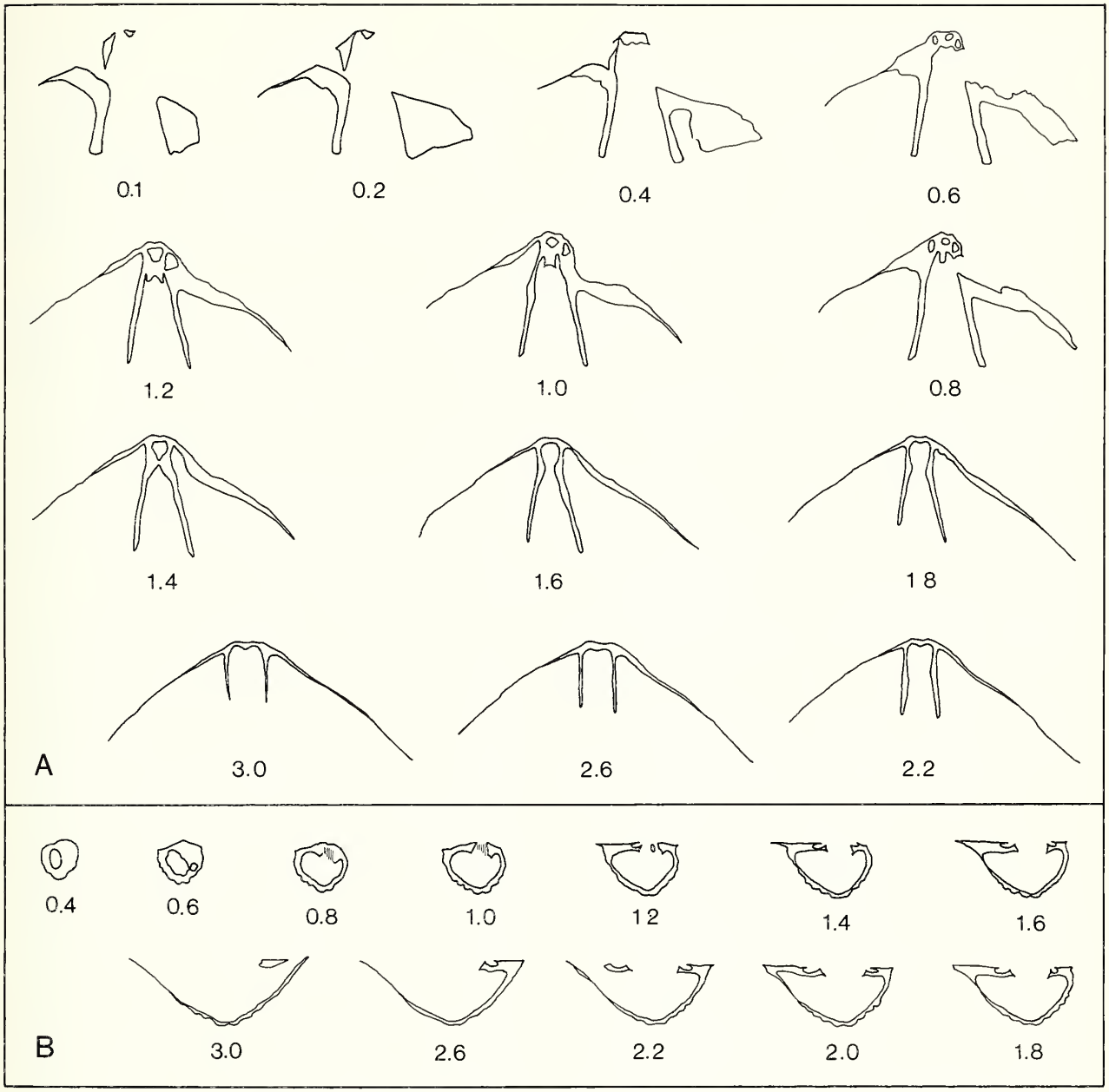


Fig. 27.—Transverse serial sections of *Zeugopleura jeffersonensis* (Weller) from SL397. A, large pedicle valve, CM 34746, ×1.5; B, medium sized brachial valve, CM 34747, ×2. Numbers refer to distance in mm from beak.

←

Fig. 26.—*Zeugopleura jeffersonensis* (Weller); 25.1, 25.2, micro-ornament (×10); 25.3–25.6, ventral, anterior, posterior and lateral views of the lectotype from SL397, FMNH UC11350; 25.7–25.14, 25.19–25.28, ventral, anterior, posterior and lateral views of five pedicle valves from SL393, IGS 80P84–80P88; 25.15–25.18, ventral, anterior, posterior and lateral views of an asymmetrical pedicle valve from SL396, CM 34743; 25.29–25.31, 25.38–25.40, dorsal, lateral and anterior views of two large spalled brachial valves from SL393, IGS 80P89, 80P90; 25.32–25.35, dorsal and anterior views of two large well preserved brachial valves from SL396, CM 34744, 34745; 25.36, 25.37, dorsal and anterior views of a brachial valve paralectotype from SL397, FMNH UC11350; 25.41, 25.42, two small brachial valves from SL393, IGS 80P91, 80P92; all ×1.5 except 25.1 and 25.2, ×10.

lines, and slightly coarser elongated papillae arranged in quincunx; shell substance finely endopunctate.

Pedicle valve subpyramidal, much thicker than brachial valve, with maximum thickness in umbonal region; flanks sloping evenly to antero-lateral margins; umbonal region strongly inflated with small acute incurved beak; ventral interarea proeline, or more rarely, nearly catacline, high, weakly concave, defined by slightly rounded beak ridges; longitudinally grooved perideltidial areas large, extending over most of interarea; delthyrium moderately broad but higher than wide; subdelthyrial plate small, set well below surface of interarea between dental adminicula; deltidial cover not observed; sulcus originating at beak as narrow groove, becoming deeper and wider anteriorly but remaining shallow throughout with flattened bottom in most specimens, rarely rounded, producing moderate tongue; interior with long diverging dental adminicula that extend forward one-third to one-half length of valve.

Brachial valve transversely subelliptical in outline, most convex in umbonal region, and much thinner than opposite valve with maximum thickness near or posterior to midlength; umbo slightly swollen; flanks sloping evenly to antero-lateral margins, more steeply toward hingeline; fold originating at small inconspicuous dorsal beak, well defined by sulcus-bounding grooves, rising moderately toward anterior margin, often becoming slightly flattened medially; interior with unsupported striate cardinal process and wide sockets; other internal details not observed.

Distinguishing characters.—This species is characterized by its transversely subelliptical outline, moderately high concave procline ventral interarea with large perideltidial areas, well-defined low fold and shallow flattened sulcus with a pair of ribs in the sulcus, and 10–12 simple flattened costae on the flanks.

Remarks.—*Zeugopleura jeffersonensis* (Weller) is not readily confused with other syringothyridiidines in the North American mid-continent. *Spirifer compositus* Girty, 1928, from the Riddlesburg Shale of Pennsylvania is closely similar to the Glen Park species. It differs, if at all, in its smaller size and better defined ribs in the sulcus and on the fold. Girty (1928:118) stated that no subdelthyrial plate was present but his specimens were distorted molds and fragments and clearly did not afford a complete description of the species.

Distribution.—*Zeugopleura jeffersonensis* (Weller) is one of the most common Glen Park species, occurring in abundance at localities SL393, SL396, and SL397. It is less common at localities SL395 (1 specimen) and SL511 (7 specimens).

Order Terebratulida Waagen
Suborder Terebratulidina Waagen
Superfamily Dielasmatacea Schuchert
Family Cranaenidae Cloud
Subfamily Cranaeninae Cloud
Genus ***Hamburgia*** Weller, 1911

Hamburgia typa Weller, 1911
Fig. 24.1–24.34, 28

v*1911 *Hamburgia typa* Weller, p. 446, fig. 6.
v*1914 *Hamburgia typa* Weller: Weller, p. 283–284, pl. 31, fig. 16–18; textfig. 36.

Lectotype.—Designated herein, a medium sized pedicle valve, FMNH UC14245, Fig. 24.19, Weller Collection, from loeality SL395, Hamburg, Calhoun County, Illinois; illustrated by Weller (1914:pl. 31, fig. 16).

Paralectotypes.—19 in all, all numbered FMNH UC14245; one pedicle valve and one brachial valve were illustrated by Weller (1914:pl. 31, fig. 17, 18); same collection as the lectotype.

Emended description.—Average size for genus, subequally biconvex, outline usually almost symmetrical, longitudinally subelliptical, subrhomboidal or obscurely subpentagonal; greatest width near midlength; lateral profile lenticular; greatest thickness slightly posterior to midlength; anterior commissure rectimarginate; fold and sulcus lacking; ornamentation lacking except for concentric color banding on lectotype (see Fig. 24.19) and irregularly spaced growth lines.

Pedicle valve moderately and evenly eonvex, most convex in umbonal region; venter rounded, flanks sloping evenly to antero-lateral margins, more steeply to cardinal margins; umbonal region narrowly swollen, beak suberect, foramen large, ovate, labiate, permesothyridid or epithyridid; beak ridges rounded, poorly defined; delthyrium closed by conjunct deltidial plates; interior with short pedicle collar, slender diverging dental plates that closely approximate sides of umbonal region, and bladelike teeth.

Brachial valve most convex umbonally, evenly eonvex on dorsum, flanks sloping gently and evenly to antero-lateral margins; umbonal region defined by concave flexures, lateral extremities slightly compressed; beak small, obscured by ventral beak; interior with open umbonal region; sockets broad and deep, inner socket ridges stout and high; deeply concave hingeplate sessile posteriorly, rising slightly off floor of valve anteriorly; crural bases originate anteriorly at free end of hingeplate as V-shaped processes; crural processes very high, nearly parallel, extending into ventral valve in juveniles (Fig. 28B); loop short, with narrow ventrally convex transverse band in adults and short vertical medial plate in juveniles.

Distinguishing characters.—The nearly symmetrical subrhomboidal to subelliptical outline, moderate size, and weakly convex flanks serve to characterize this species.

Remarks.—*Hamburgia chappelensis* Carter, 1967, from the Chappel Limestone of central Texas and *Hamburgia flora* (Winchell) from the Logan Formation of Ohio as illustrated by Hyde (1953:pl. 37, fig. 1–12, 17–20) can both be distinguished from *Hamburgia typa* Weller by their larger size and subpentagonal outlines. One of Hyde's drawings (1953: pl. 37, fig. 19) shows very high crural processes, extending into the cavity of the pedicle valve, which

Table 34.—*Measurements (in mm) of the lectotype and three mature complete specimens of* Hamburgia typa *Weller, 1911, from the Glen Park Formation.*

Specimen no.	Locality	Length	Width	Thickness
Lectotype (pedicle valve)				
FMNH UC14245	SL395	19.8	18.2	8.1
CM 34734	SL393	20.0	16.9	11.2
CM 34735	SL393	15.7	13.4	9.2
CM 34736	SL393	12.5	11.4	6.7

suggests that unusually high crural processes may be of taxonomic importance in the definition of this genus.

Distribution.—This is a common species at localities SL393, SL395 and SL396.

Family Heterelasminidae Likharev
Genus ***Beecheria*** Hall and Clarke, 1893

Beecheria paraplicata Rodriguez and Gutschick, 1967
Fig. 29.31–29.43

1967 *Beecheria paraplicata* Rodriguez and Gutschick, p. 381, pl. 44, fig. 1–5, 30, 39, 40.

Holotype.—UND 354, from Unit E of the Sappington Formation, western Montana. The authors considered this unit to be of Mississippian age but Sando et al. (1969:E9) suggested that this unit is Devonian.

Paratypes.—UND 335, UND 356–360.

Diagnosis.—Large *Beecheria* with subtruncate anterior margin and paraplicate anterior commissure.

Remarks.—The dorsal sulcus in these Glen Park specimens is not quite as distinct as in the Sappington types. These Glen Park specimens are moderately smaller than the Sappington specimens measured by Rodriguez and Gutschick (1967:table 4) but otherwise agree in most respects with their description of *Beecheria paraplicata.* The specimens illustrated here show the range of variation in size and proportions of typical Glen Park specimens. Most specimens are wider than Fig. 29.31 and narrower than Fig. 29.39.

Table 35.—*Measurements (in mm) of the illustrated specimens of* Beecheria paraplicata *Rodriguez and Gutschick from the Glen Park Formation at locality SL393, Pike County, Illinois.*

Specimen no.	Length	Width	Thickness
Pedicle valves			
IGS 80P100	32.8	21.7	12.5
IGS 80P101	25.7	18.5	9.0
IGS 80P102	22.0	17.5	5.5
Brachial valves			
CM 34748	27.2	23.3	6.5
IGS 80P103	24.9	22.9	6.6
IGS 80P104	29.0	22.1	8.1

Rodriguez and Gutschick compared juveniles of their new species with *Beecheria chouteauensis* (Weller, 1914). Mature specimens are readily distinguished by their paraplicate anterior commissure.

Distribution.—In the Glen Park Formation this species is common at locality SL393 (23 specimens), and rare at SL396 (1 specimen), and SL397 (9 specimens).

Superfamily Cryptonellacea Thomson
Family Cryptonellidae Thomson
Genus ***Dielasmella*** Weller, 1911

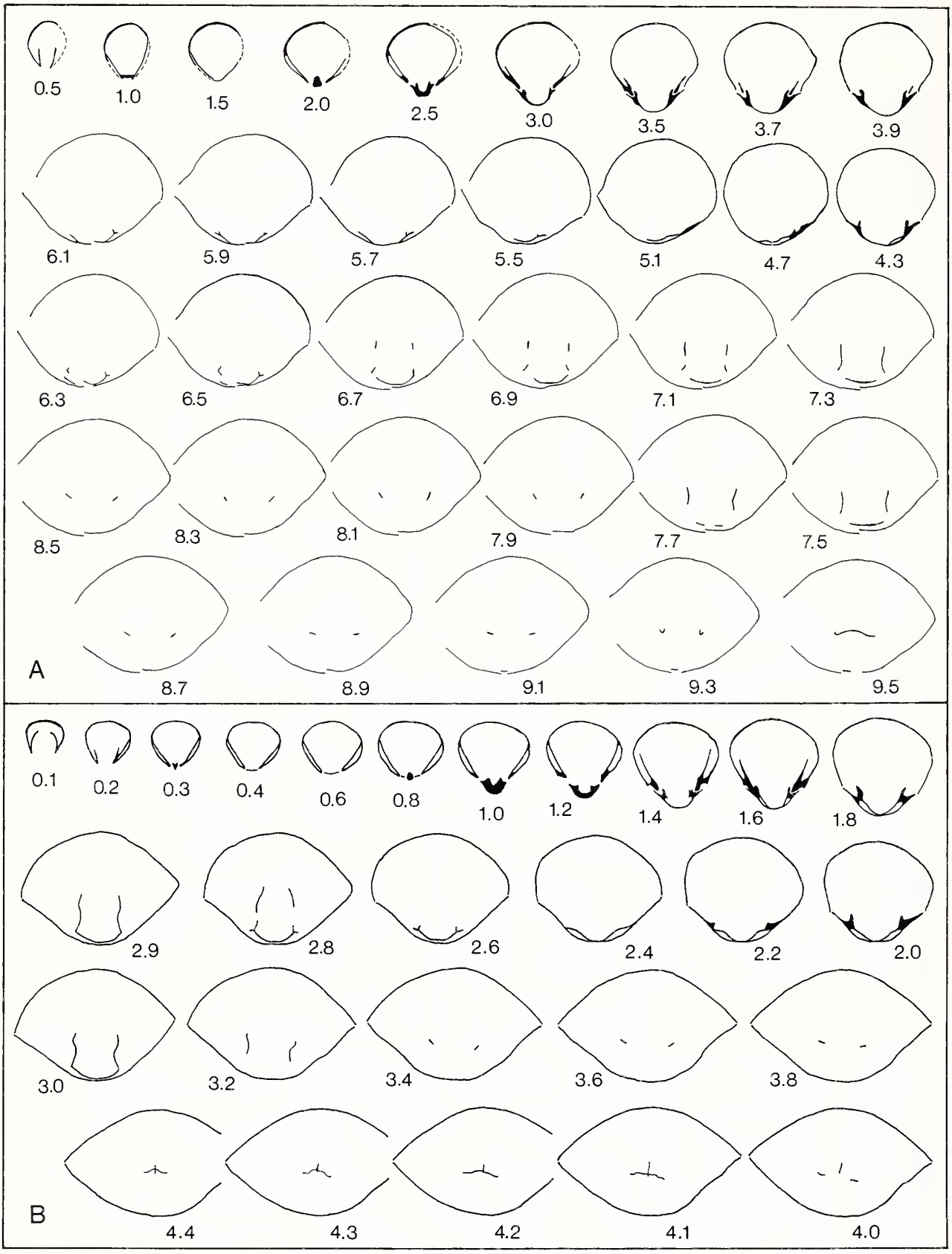
Dielasmella compressa (Weller, 1906)
Fig. 29.1–29.30, 30

v*1906 *Eunella compressa* Weller, p. 442–443, pl. 6, fig. 13–16.
1911 *Dielasmella compressa* (Weller): Weller, p. 447, fig. 7a–f.
1914 *Dielasmella compressa* (Weller): Weller, p. 280–281, pl. 30, fig. 43–55.
v.1914 *Dielasmella calhounensis* Weller, p. 281–282, pl. 31, fig. 1–4, textfig. 35.
1938*a* *Dielasmella compressa* (Weller): Branson, p. 134, pl. 16, fig. 16–18.
?1938*b* *Dielasmella compressa* (Weller): Branson, p. 31, pl. 22, fig. 23, 24.

→

Fig. 28.—Transverse serial sections of *Hamburgia typa* Weller from SL397. A, large specimen with fractured dorsum, IGS 80P93, ×2; B, small immature specimen, IGS 80P94, ×5. Numbers refer to distance in mm from beak.

Fig. 29.—Terebratulids. 29.1–29.30, *Dielasmella compressa* (Weller); 29.1–29.6, ventral, dorsal and lateral views of two large specimens from SL395, syntypes of *Dielasmella calhounensis* Weller, FMNH UC14246; 29.7–29.21, ventral, dorsal and lateral views of five medium sized specimens from SL393, IGS 80P95–80P99; 29.22–29.30, ventral, dorsal and lateral views of three small specimens from the Weller Collection, SL397, paralectotypes FMNH UC11347; all ×3. 29.31–29.43, *Beecheria paraplicata* Rodriguez and Gutschick; 29.31–29.36, ventral and lateral views of three pedicle valves, IGS 80P100–80P102; 29.37–29.43, dorsal and anterior views of three brachial valves, CM 34748 and IGS 80P103, 80P104, respectively, all from SL393; all ×1.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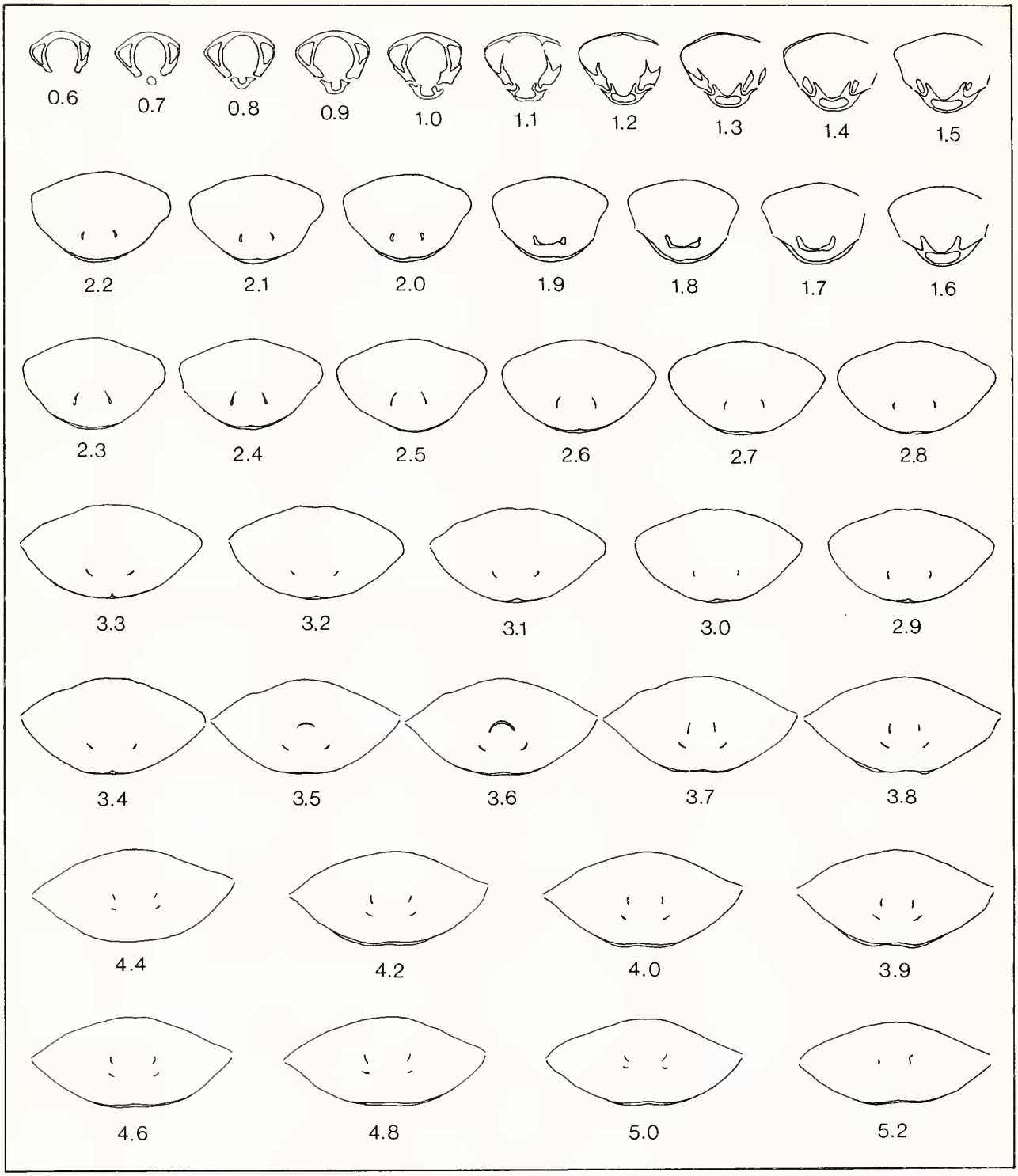

Fig. 30.—Transverse serial sections of a medium sized *Dielasmella compressa* (Weller) from SL393, IGS 80P105. Numbers refer to distance in mm from ventral beak. ×4.

1938*a* *Dielasmella calhounensis* Weller: Branson, p. 170, pl. 19, fig. 26, 27.
1944 *Dielasmella calhounensis* Weller: Cooper, p. 364, pl. 143, fig. 14–15.
1962 *Dielasmella compressa* (Weller): Stehli, p. 102, pl. 20, Group K.
1965 *Dielasmella compressa* (Weller): Stehli, p. 762, fig. 621: 4a, 4b.

Lectotype.—Designated herein, FMNH UC11347, Weller Collection from Glen Park, Missouri; illustrated by Weller (1906:pl. 6, fig. 13 and 1914:pl. 30, fig. 47, 48, 54, 55); not reillustrated here. Of Weller's four illustrated syntypes this small specimen most closely approaches the outline of larger more typical specimens within the syntype suite as well as from other localities.

Paralectotypes.—Fourteen in all, FMNH UC11347, same collection as the lectotype. Weller illustrated three of these specimens (1906:pl. 6, fig. 14–16; 1914:pl. 30, fig. 43–46, 49–53). Three additional syntypes of more typical outline are illustrated here for the first time on Fig. 29.22–29.30.

Diagnosis.—Small, thin, elongate *Dielasmella* with long umbonal region, straight to weakly concave posterolateral margins with sharp subangular beak ridges, and guttate to subrhomboidal outline; flanks flattened and smooth; greatest width anterior to midlength; weak narrow sulcus often present in one or both valves producing truncated or emarginate outline in those specimens.

Remarks.—I have placed the larger of Weller's two *Dielasmella* species, *Dielasmella calhounensis* Weller, 1914, in synonomy with *Dielasmella compressa* (Weller, 1906). Weller (1914:282) expressed doubt about the validity of *Dielasmella calhounensis* when he proposed it, noting that

> . . . it is always a larger form, however, with the brachial valve relatively more convex and with the median sinus of the pedicle valve more conspicuously developed.

On Fig. 29 the lateral profile of Weller's types of *Dielasmella calhounensis* Weller and eight smaller specimens readily assignable to *Dielasmella compressa* (Weller) can be compared for relative convexity of the valves. It can be seen at once that there is little difference between the two groups of figures. The degree of development of the ventral sinus can also be seen to be similar in both groups of figures. After examining many specimens assignable to both taxa, I can find no validity to Weller's contention that the ventral sinus is better developed in *Dielasmella calhounensis*. In Table 36, the specimens from locality SL393 show size range overlap between the types of *Dielasmella compressa* (Weller) on the one hand and the types of *Dielasmella calhounensis* Weller on the other. It should be reiterated here that specimens of several Glen Park species that occur in both Missouri and Illinois are generally smaller in Missouri than they are in Illinois. These include *Tylothyris missouriensis* (Weller), *Plicochonetes? glenparkensis* (Weller), *Nucleospira minima* Weller, and *Dielasmella compressa* (Weller).

Table 36.—*Measurements (in mm) of* Dielasmella compressa *(Weller, 1906) from the Glen Park Formation. Specimens marked with an asterisk * are illustrated on Fig. 28. Those marked with a dagger † were illustrated by Weller (1914).*

Specimen no.	Locality	Length	Width	Thickness
FMNH UC11347	SL397	3.9	3.1	1.6
FMNH UC11347	SL397	4.3	3.3	1.6
FMNH UC11347	SL397	4.6	3.8	1.7
FMNH UC11347	SL397	4.7	4.2	1.8
FMNH UC11347*	SL397	5.4	4.7	2.4
FMNH UC11347*	SL397	5.5	4.9	2.1
FMNH UC11347†	SL397	5.6	4.3	2.0
Lectotype†	SL397	5.9	5.0	2.0
FMNH UC11347*	SL397	6.0	5.0	2.2
FMNH UC11347†	SL397	+6.3	6.6	2.6
FMNH UC11347†	SL397	6.4	6.1	2.4
IGS 80P99	SL393	5.6	4.7	2.1
IGS 80P98	SL393	6.0	4.4	1.7
IGS 80P97	SL393	6.5	5.6	2.5
IGS 80P95	SL393	6.7	6.1	2.5
IGS 80P96	SL393	7.0	5.3	2.4
IGS 80P106	SL393	7.5	5.6	2.7
IGS 80P107	SL393	7.7	6.7	2.7
IGS 80P108	SL393	8.2	6.7	3.1
IGS 80P109	SL393	8.2	7.7	3.0
IGS 80P110	SL393	8.3	6.9	3.2
IGS 80P111	SL393	8.7	7.2	2.9
CM 34751	SL396	10.1	8.1	—
FMNH UC14246	SL395	8.8	7.9	—
FMNH UC14246†	SL395	10.0	8.6	3.8
FMNH UC14246†	SL395	10.7	8.6	4.5
FMNH UC14246	SL395	11.7	10.5	—
FMNH UC14246	SL395	11.8	11.3	—
FMNH UC14246	SL395	12.3	10.7	—

The only other North American species assigned to this genus is *Dielasmella larga* Carter, 1967, from the Chappel Limestone of central Texas. The latter is larger, much thicker, with weak lateral ribs on the flanks, and the maximum width is attained posteriorly, not anteriorly as in *Dielasmella compressa* (Weller).

Figure 30 shows detailed serial sections of the interior of *Dielasmella compressa* (Weller) from Brown Branch, Pike County, Illinois. These sections are in general agreement with those of Weller (1911)

for *Dielasmella compressa* from Glen Park, Missouri, and Stehli's (1962) photographs of the loop of a specimen from the Hamburg Oolite at Hamburg, Illinois. One minor difference is that the transverse band in the Pike County specimen is posteriorly convex similar to most dielasmataceans, not weakly concave as indicated by Stehli (1962:text-fig. 1C).

Distribution.—This species is moderately common at localities SL397 (more than 22 complete specimens, plus disarticulated valves), SL393 (25 complete specimens, numerous disarticulated valves), and SL395 (2 complete specimens, 9 disarticulated valves, numerous specimens in other museums). One large specimen was recovered at locality SL396.

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